RESTRICTIVE TRADE
PRACTICES COMMISSION

# Telecommunications in Canada

## Phase I
## Interconnection

# RESTRICTIVE TRADE PRACTICES COMMISSION

# TELECOMMUNICATIONS IN CANADA

## PART I - INTERCONNECTION

Report in the Matter of an Inquiry under section 47 of the Combines Investigation Act relating to the Manufacture, Production, Distribution, Purchase, Supply and Sale of Communication Systems, Communication Equipment and Related Products

Ottawa

1981

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Cat. No. RG 52-17/1981E

ISBN 0-662-11758-1

5M-RTPC-81-1

Cette publication est également disponible en français.

# RESTRICTIVE TRADE PRACTICES COMMISSION

## TELECOMMUNICATIONS INQUIRY

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Restrictive Trade
Practices Commission

Commission sur les pratiques
restrictives du commerce

September 10, 1981

The Honourable André Ouellet, P.C., M.P.,
Minister of Consumer and Corporate Affairs,
House of Commons,
Ottawa, Ontario
K1A 0A6

Dear Sir:

I have the honour to transmit to you the French and English texts of Part I of a report by the Restrictive Trade Practices Commission entitled "Telecommunications in Canada - Part I - Interconnection". Part II will deal with the other questions arising in this inquiry.

This report follows from an inquiry carried out under section 47 of the Combines Investigation Act relating to the manufacture, production, distribution, purchase, supply and sale of communication systems, communication equipment and related products.

Yours very truly,

L.-A. Couture,
Vice-Chairman.

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# CHAPTER I

# INTRODUCTION

## 1. Origin of the Inquiry

This is Part I of a two-part report in a long and difficult inquiry. The Restrictive Trade Practices Commission received the Statement of Material (hereinafter referred to as the "Green Book") by the Director of Investigation and Research, *Combines Investigation Act* on December 20, 1976. In February and March 1977, the RTPC forwarded the Green Book to all named parties and all those who expressed the wish to participate in the hearings. It published notice in all major newspapers across Canada, held a pre-hearing conference on June 15, 1977, and began public hearings in September 1977. It heard over 200 witnesses in the course of 228 days of hearings, the transcript of which covered close to 35,000 pages. It received 2000 exhibits. Appendix A contains a list of the witnesses and shows that the Commission sat in major cities in all the provinces. A very large portion of the evidence dealt with interconnection. Final argument on interconnection took place in August and September 1980.

Section 47 of the *Combines Investigation Act*, under which this inquiry proceeded, provides:

> "Investigation of Monopolistic Situations
>
> 47. (1) The Director
> (a) upon his own initiative may, and upon direction from the Minister or at the instance of the Commission shall, carry out an inquiry concerning the existence and effect of conditions or practices relating to any product that may be the subject of trade or commerce and which conditions or practices are related to monopolistic situations or restraint of trade, and

> (b) upon direction from the Minister shall carry out a general inquiry into any matter that the Minister certifies in the direction to be related to the policy and objectives of this Act,
>
> and for the purposes of this Act, any such inquiry shall be deemed to be an inquiry under section 8.
>
> (2) It is the duty of the Commission to consider any evidence or material brought before it under subsection (1) together with such further evidence or material as the Commission considers advisable and to report thereon in writing to the Minister, and for the purposes of this Act any such report shall be deemed to be a report under section 19."

An investigation into the telecommunication equipment industry was initiated by the Director of Investigation and Research, *Combines Investigation Act*, in September 1966. It resulted from complaints received by the Director which led him to conclude that Bell Canada's ownership of its principal equipment supplier, Northern Electric Company, Limited* was likely to spread monopoly from Bell's activities, which are regulated, into the non-regulated activities of Northern Electric (primarily the production and sale of telecommunication equipment). The Green Book states that:

> "These complaints raised questions concerning: (a) the purchasing practices of Bell Canada with respect to telecommunication equipment; (b) the policies followed by Bell Canada with respect to attachment of equipment to its telephone network; (c) the preferential position of Bell Canada's subsidiary, Northern Electric, arising in part from the practice of Bell Canada providing Northern Electric with a large captive market for telecommunication equipment; and (d) the possibility that Northern Electric was able to engage in predatory pricing either because Bell Canada was purchasing equipment

---

* The name of the company was changed to Northern Telecom Limited on March 1, 1976.

from Northern Electric at unreasonably high prices or because Bell Canada was subsidizing Northern Electric's operation in other ways out of revenue from Bell Canada's regulated business.

As a result of preliminary inquiries the Director of Investigation and Research ascertained that Northern Electric held a dominant position in the market for telecommunication equipment in Canada and that well over half of its total sales of such equipment were to Bell Canada and its affiliated telephone operating companies at that time. The Director also ascertained that when offered at least equal prices from potential suppliers and Northern Electric, Bell Canada's business was directed to Northern Electric, and that this placed their subsidiary in an advantageous position with respect to its competitors. Finally, the Director of Investigation and Research also became aware that over a period of years prior to September 1966, Bell Canada had been expanding its telephone system in Canada by numerous acquisitions of telephone companies, which acquisitions had the effect of further expanding the already large captive market available to Northern Electric.

. . .

the Director concluded he had reason to believe section 33 as defined by section 2(e) and (f) of the *Combines Investigation Act* (R.S.C. 1960, c. 45 s.1) was being or was about to be violated and he acccordingly initiated a formal inquiry. The sections, dealing with merger and monopoly, are set out below:

> '33. Every person who is a party or privy to or knowingly assists in, or in the formation of, a merger or monopoly is guilty of an indictable offence and is liable to imprisonment for two years.
>
> 2(e) "merger" means the acquisition by one or more persons, whether by purchase

> or lease of shares or assets or otherwise, of any control over or interest in the whole or part of the business of a competitor, supplier, customer or any other person, whereby competition
> (i) in a trade or industry,
> (ii) among the sources of supply of a trade or industry,
> (iii) among the outlets for sales of a trade or industry, or
> (iv) otherwise than in subparagraphs (i), (ii) and (iii),
>
> is or is likely to be lessened to the detriment or against the interest of the public, whether consumers, producers or others;
>
> (f) "monopoly" means a situation where one or more persons either substantially or completely control throughout Canada or any area thereof the class or species of business in which they are engaged and have operated such business or are likely to operate it to the detriment or against the interest of the public, whether consumers, producers or others, but a situation shall not be deemed a monopoly within the meaning of this paragraph by reason only of the exercise of any right or enjoyment of any interest derived under the *Patent Act*, or any other Act of the Parliament of Canada;'

. . .

In January, 1973, the Director, having examined the evidence obtained in the matter, concluded that it did not disclose a situation contrary to any provision of Part V of the *Combines Investigation Act* [which relates to violations of the Act which are criminal offences, including merger or monopoly].

> It did, however, disclose that there existed conditions or practices relating to a monopolistic situation such as to warrant inquiry and reporting under section 47 of the Act. On January 23, 1973, the Director filed a notice of his decision to commence such an inquiry with the Restrictive Trade Practices Commission, stating that the evidence and material obtained in the earlier inquiry would form part of the evidence and material of the section 47 inquiry. A copy of the notice was sent to Bell Canada and to Northern Electric Company, Limited."

It is further stated in the Green Book:

> "Section 27.1 of the recently revised *Combines Investigation Act* provides that the Director may make representations before a federal regulatory board in respect to competition relevant to the matter before such a board. It is however the Director's position that the issues disclosed in this inquiry are of too broad a nature to be adequately treated through a section 27.1 intervention by the Director. In the Director's opinion the proper procedure for determining the public policy implications of this inquiry is to proceed with submission of this evidence to the Restrictive Trade Practices Commission for their consideration pursuant to section 47.2: . . ."

## 2. Interconnection as an Issue in the Inquiry

In a letter to the Commission dated October 5, 1977, Counsel for Bell Canada requested:

> ". . . that directions be given by the Commission to limit the scope of the interconnection arguments that can either be presented to this Commission or pursued under cross-examination during the course of this inquiry."

Bell's request resulted from the presentation, during the early days of the hearings, of evidence related to the connection of terminals to telecommunication networks and the interconnection of telecommunication networks:

> "In association with this subject, the issues of telephone company pricing practices, technical interface and service problems, and what constitutes telephone services which a telephone company is obliged to provide have been debated."

On Thursday, October 13, 1977, a special hearing was held to hear argument on the matter. Counsel for Bell asked:

> ". . . the Commission to make an order that the evidence as to the reasons for and the desirability of interconnection policies should not be admissible for the purposes of this hearing."

Bell's first argument in support of its application is summarized in the letter:

> ". . . it is only relevant for this inquiry to consider evidence relating to the effect of vertical integration on the telecommunication equipment market in Canada. . . . it is not relevant to consider the effects of existing terminal connection and network interconnection policies which do not flow from vertical integration."

As suggested by Counsel for the Government of Ontario, determination of this issue depends on whether a narrow interpretation of the short title of the Green Book, "The Effects of Vertical Integration on the Telecommunication Equipment Market in Canada", is to be used. The full title of the material presented by the Director clearly allows scope for an inquiry into telecommunication equipment which is not limited to the effects of vertical integration.

A second line of argument used by Bell is that matters subject to regulation should be excluded from the inquiry. This position was divided into four points:

> "First, the Commission should not in this Inquiry . . . permit evidence to be received as to any matter in which the regulatory jurisdiction is in a province.

> . . .
>
> Secondly, the Commission should interpret section 47 as excluding from its jurisdiction all monopolistic practices which Parliament has subjected to regulation.
>
> . . .
>
> Thirdly, the Commission . . . should apply the doctrine of primary jurisdiction and leave the issue of interconnection to the regulatory bodies which have peculiar expertise in the area.
>
> . . .
>
> Fourthly, simply as a matter of convenience the Commission should, as it has a right to do under section 47, limit further evidence so as to exclude the interconnection issue. While other regulatory bodies have proceedings before them on interconnection, the issue should be left there also on the ground of fairness. . . ."

The last point in effect forms a separate argument. It was made primarily with respect to an application for system interconnection by Canadian Pacific Limited to the Canadian Radio-television and Telecommunications Commission (CRTC).

> "If Bell Canada is required to give evidence in this inquiry as to the issues involved in the Canadian Pacific case, Canadian Pacific will have all of the advantages of a pre-hearing which will be denied to Bell Canada. It is our submission that when the CRTC is empowered to decide such issues the parties to a case before the CRTC should not have, in the case of Canadian Pacific, an advantage of a pre-hearing and, in the case of Bell Canada, the disadvantage of discovery of its case."

Thus, Bell's concern in this regard was with respect to the timing of certain evidence.

Bell's application was supported by British Columbia Telephone Company and Northern Telecom Limited.

Counsel for the Ontario Government saw it as necessary for the Commission to walk a fine line: it should hear all evidence relevant for a proper understanding of the telecommunication equipment market, but without entering into a discussion "of the degrees of liberalization of restrictions on terminal interconnection . . .". These matters, he said, necessarily raised questions regarding the economic impact of interconnection on telecommunication carriers and would require extensive investigation.

Counsel for the Government of Quebec took the position that interconnection should be examined from the viewpoint of the effect of vertical integration on the telecommunication equipment industry, having regard to the public interest as it is usually considered in combines inquiries, but bearing in mind that telecommunication carriers are regulated and telecommunication jurisdiction is shared.

Counsel for the Director argued that "any material or evidence relating to competition in the telecommunication equipment market is relevant . . ." to the inquiry, is within the jurisdiction of the Commission, and it is the Commission's duty to hear it.

The Commission ruled on October 25, 1977 that:

> ". . . The Commission clearly is exercising proper jurisdiction in seeking information on interconnection/attachment policies, as factual matters so that it may understand conditions and practices that prevail in the sphere of telecommunications equipment.
>
> . . .
>
> Having regard to its duty to inquire and report the Commission must deem it advisable to have all the evidence which is relevant to the matter under investigation and which it must consider to make appropriate recommendations. In the furtherance of

> these goals, the Commission believes it must understand the reasons underlying interconnection policies. . . ."

Many cases have been dealt with by the Courts and by the CRTC and many events have transpired since the start of this inquiry in relation to the important issue of interconnection. Cases such as *Challenge, Harding,* etc., are discussed in Chapter V. The most important event is the application on November 13, 1979 by Bell Canada to CRTC requesting a review of Rule 9, which prohibited the connection of customer-provided terminal equipment. CRTC responded with an interim decision on August 5, 1980 that allowed subscriber-provided terminal equipment to be attached to Bell Canada's facilities provided either that it meet the requirements of Bell Canada,* or be of the same class or manufacture as that provided by Bell Canada, or meet the current requirements of the Federal Communications Commission (FCC) of the United States. CRTC will hold hearings in the latter part of 1981 after which it will render its final decision.

The RTPC has decided to divide its Report into two parts so that it may be as timely as possible. Part II will deal with central office and transmission equipment and with the issue of vertical integration, i.e., the relationship between Bell Canada, Northern Telecom Limited and Bell-Northern Research Ltd., as well as the relationship between British Columbia Telephone Company and GTE Automatic Electric (Canada) Ltd., GTE Lenkurt Electric (Canada) Ltd. and AEL Microtel Limited.

This introduction describes the main players - the telecommunication carriers and the suppliers. Chapter II deals with telecommunication networks and equipment, Chapter III, with the manufacture of voice terminals, and Chapter IV, with the purchase and supply of terminal equipment.

---

* Document TCS-130, *Terminal Connection Standards for Single Line Network Addressing Devices, Key Telephone Systems, PBX,* dated January 1980.

Chapter V consists of an overview of interconnection in Canada, and Chapter VI, in other countries. Chapter VII describes equipment options and some users' complaints. Chapter VIII offers conclusions and recommendations.

## 3. Telecommunication Carriers

Telecommunication services in Canada are provided by a combination of privately and publicly owned common carriers. Some are subject to federal legislative authority and regulation; others fall under provincial jurisdiction. These carriers provide facilities for the transmission of both voice and non-voice traffic, the latter including telegrams, telex, data and video. Although the specialized services exhibit rapid growth, public telephone signals constitute the major part of telecommunication traffic.

### a) Telephone Companies

The telephone companies supply public telephone service. While there were over 200 companies operating in Canada in 1979, 15 major companies accounted for slightly under 99 per cent of the 15.8 million telephones in service at January 1, 1980.

Table 1 indicates the 15 major Canadian telephone companies at January 1, 1980.

Bell Canada is by far the largest, accounting for close to 60 per cent of the telephones in Canada. Bell is privately owned. It operates in most of Ontario and Quebec and in some parts of the Northwest Territories. Although the American Telephone & Telegraph Corporation (AT&T), the giant U.S. telephone system, had equity interest in Bell for 95 years, the ownership share never exceeded 49 per cent. It dropped to 25 per cent by 1930, to 2 per cent by 1970 and was eliminated in 1975. At one time Bell served not only Ontario and Quebec but also the Prairie Provinces and the Maritimes. Bell has substantial equity interest in the principal telephone companies in the Atlantic Provinces. Bell, at December 31, 1979 owned 66 per cent of the common shares of Newfoundland Telephone (formerly Avalon), approximately

## TABLE 1

## MAJOR CANADIAN TELEPHONE OPERATING COMPANIES

(January 1, 1980)

| Company | Telephones (thousands) | Telephones as % Total |
|---|---|---|
| Bell Canada | 9,222 | 58.4 |
| British Columbia Telephone Company (B.C. Tel) | 1,787 | 11.3 |
| Alberta Government Telephones (AGT) | 1,116 | 7.1 |
| Manitoba Telephone System (MTS) | 679 | 4.3 |
| Saskatchewan Telecommunications (Sask Tel) | 584 | 3.7 |
| Maritime Telegraph and Telephone Company, Limited (MT&T) | 474 | 3.0 |
| 'edmonton telephones' | 437 | 2.8 |
| The New Brunswick Telephone Company, Limited (NBTel) | 377 | 2.4 |
| Québec-Téléphone | 265 | 1.7 |
| Newfoundland Telephone Company Limited (Newfoundland Telephone) | 193 | 1.2 |
| Télébec Ltée | 155 | 1.0 |
| Thunder Bay Utilities | 92 | .6 |
| Canadian National Telecommunications (CN) | 89 | .6 |
| Northern Telephone Limited (Northern Tel) | 71 | .4 |
| The Island Telephone Company Limited (Island Tel) | 64 | .4 |
| TOTAL | 15,605 | 98.8* |
| TOTAL (Canada) | 15,800 | 100.0 |

SOURCE: *Northern Telecom Product Handbook*, 1980 edition.

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* May not add exactly owing to rounding.

40 per cent of the outstanding common shares of MT&T and NBTel, and an equity interest in Island Tel through MT&T. Bell's voting rights in MT&T, like those of other shareholders, are limited by provincial statute to 1,000 shares. Parts of Ontario and Quebec are served by Bell subsidiaries, chiefly by Télébec Ltée (100 per cent of common shares owned by Bell) and Northern Telephone Limited (99.8 per cent). Bell and these subsidiary and affiliated companies account for approximately 67 per cent of the telephones in Canada and the vast majority of the telephones east of Manitoba. Except for Bell Canada, which is federally incorporated and regulated by the CRTC, these companies are all provincially incorporated and regulated.

B.C. Tel is the second largest telephone company in Canada, with approximately 11 per cent of the country's telephones. The General Telephone & Electronics Corporation (GTE) of Stamford, Connecticut is the majority shareholder of B.C. Tel through the Anglo-Canadian Telephone Company. Anglo-Canadian is a Quebec-based holding company which is controlled by GTE, whose telephone companies account for about 10 per cent of the telephones in the U.S. and place GTE a distant second after AT&T. The Okanagan Telephone Company, second in size to B.C. Tel in the Province of British Columbia, is a wholly owned subsidiary of B.C. Tel. B.C. Tel is related to Québec-Téléphone (whose 265,000 telephones make it second to Bell in Quebec) through their common parent, the holding company, Anglo-Canadian. While B.C. Tel is federally incorporated and regulated by the CRTC, Québec-Téléphone is subject to the jurisdiction of the Public Service Board of the Province of Quebec.

The three largest telephone companies in the Prairie region are all provincial Crown corporations. These are AGT, MTS and Sask Tel. Bell completely withdrew from serving the Prairie provinces in 1908-09, selling its facilities to the respective provincial governments. AGT and MTS are regulated by their provincial public utility boards. Sask Tel is responsible to the provincial legislature.

The other major Canadian telephone companies are 'edmonton telephones', which is a municipally owned utility controlled by the Council of the City of Edmonton; Thunder

Bay Utilities, also a municipal utility; and CN, a federal crown corporation whose two subsidiary telephone companies, Terra Nova Telecommunications Inc. and Northwest Telecommunications, operate in Newfoundland and the Northwest respectively and are regulated by the CRTC.

### b) TransCanada Telephone System

Nine of the major telephone companies and Telesat Canada form the TransCanada Telephone System (TCTS). These nine companies together operate in all 10 provinces and account for 92 per cent of the telephones in service. They are as follows:

1. British Columbia Telephone Company
2. Alberta Government Telephones
3. Saskatchewan Telecommunications
4. Manitoba Telephone System
5. Bell Canada
6. The New Brunswick Telephone Company, Limited
7. Maritime Telegraph and Telephone Company, Limited
8. The Island Telephone Company Limited
9. Newfoundland Telephone Company Limited
10. Telesat Canada

Coast-to-coast communication services are organized under TCTS, a non-incorporated, voluntary association. Until its formation in 1931, Canadian transcontinental calls were routed through the U.S. These companies together operate a coast-to-coast microwave relay network. In addition to public telephone service, they offer specialized computer communications, message-record, video and private line voice services. Although each member company is regulated, TCTS is not subject to a regulatory authority. In 1978, however, CRTC initiated a review of TCTS's rates, practices and revenue settlement procedures as a result of applications by Bell and B.C. Tel for changes to their TCTS-related tariffs.

### c) Canadian National-Canadian Pacific Telecommunications (CNCP)

CNCP Telecommunications is a consortium of the telecommunication departments of Canadian National Railways and Canadian Pacific Limited since January 1, 1980. Previously it operated joint services under an agreement between CNT and CPT. The original TCTS coast-to-coast network leased approximately 25 per cent of its system's total mileage from Canadian Pacific which provided, as did Canadian National, coast-to-coast telegraph service. CNCP is the exclusive supplier of public message (telegraph, cablegram) service in Canada and between Canada and the U.S. Like TCTS, CNCP operates a transcontinental microwave network. CNCP competes with the TCTS group in providing telecommunication services other than public telephone and telegraph. These include various non-voice and private line voice offerings, i.e., CNCP's Telex, TCTS's TWX services, CNCP's Infoswitch, TCTS's Datapac, etc.

Although CNCP's transcontinental microwave network roughly parallels that of TCTS, CNCP does not operate a parallel system of local distribution loops. Because telephone company policies restricting interconnection with telco facilities lessened its ability to compete in the private line and computer communication service areas, CNCP had applied to CRTC to grant it interconnection with Bell's facilities for certain services. CRTC approved this application on May 17, 1979. One result of this was to enable CNCP to offer dial access to services for which it had not previously been available.

### d) Teleglobe Canada

The exchange of telecommunication services between Canada and the United States, which is provided through the integrated North American grid, is organized under TCTS, CNCP and the respective U.S. carriers. Other international telecommunication is organized under Teleglobe Canada, a federal Crown agency.

Teleglobe (formerly Canadian Overseas Telecommunication Corporation) was established in 1950. Initially, Teleglobe acquired telegraph and radio-telephone facilities. From 1956, Teleglobe has participated in the establishment of submarine cables crossing the Atlantic and Pacific Oceans. A founding member of the International Telecommunications Satellite Organization (INTELSAT), which was established in

1964, Teleglobe has four earth stations linking Canada to the rest of the world by satellite.

Teleglobe's transmission facilities converge on the three international gateway centers in Vancouver, Toronto and Montreal. Telephone, telegraph, Telex, TWX and other services are connected to countries outside North America through Teleglobe's facilities. Internationally, as domestically, telephone signals constitute the most significant type of telecommunication traffic, both in terms of volume and value.

### e) Telesat Canada

Domestic satellite service is provided by Telesat Canada, which was established by the federal government in 1969. It is owned jointly by the federal government and the common carriers and is an associate member of TCTS. Commercial service began in January 1973, after Telesat's first satellite was placed in orbit. Two additional satellites followed. In addition to its satellites, Telesat operates earth stations in various locations in Canada to receive and transmit telecommunication signals.

Telesat's system transmits voice, data, facsimile, television and radio signals and is interconnected with terrestrial domestic systems. It also provides telecommunication services across Canada's northern territories and in the northern portions of some of the provinces.

TCTS and CNCP use Telesat routes across the southern portion of Canada, from Toronto to Vancouver Island. In addition, Bell Canada utilizes Telesat routes to provide services in northern Ontario and northern Quebec as well as in part of the Northwest Territories. The Canadian Broadcasting Corporation (CBC) distributes television programs across Canada by way of Telesat facilities. Some routes terminate at major centers, the signals being transmitted further by means of terrestrial facilities; other routes carry television programs to remote areas in Canada. Teleglobe also makes use of Telesat facilities to extend an international transmission facility from north of Halifax to facilities in Toronto.

### f) Radio Common Carriers and Cable Television Companies

Other carriers which provide telecommunication services include the radio common carriers (RCCs) and the cable television companies. The RCCs are allocated frequencies pursuant to licences granted under the *Radio Act*. They provide radio-paging services, as do the telephone companies. Questions of access to telephone company facilities by the RCCs are before CRTC.

The cable television companies, which are regulated by CRTC under the provisions of the *Broadcasting Act*, provide facilities which as yet are largely used for the local distribution of video signals. These companies could potentially provide two-way interactive services on their coaxial cable. At present they are introducing various alarm services based on their established facilities.

## 4. Vertical Integration

The two largest Canadian telephone companies, Bell and B.C. Tel, belong to vertically integrated groups. Bell is the major shareholder in NTL, with approximately 55 per cent of its shares at December 31, 1980. NTL, with telecommunication equipment sales of $1.75 billion in 1980, is Canada's largest supplier of telecommunication equipment; $1.08 billion of these sales were made in Canada. Bell and its affiliated carriers are NTL's largest customers, accounting for approximately 40 per cent of NTL's world-wide sales. In previous years these companies took an even larger share of NTL's sales. Bell and NTL together own Bell-Northern Research Ltd. (BNR), which is the largest industrial research and development (R&D) establishment in Canada.* BNR is currently owned 70 per cent by NTL and 30 per cent by Bell Canada and undertakes the major part of their research activities. The ownership interest is intended to correspond to the funding of BNR's activities and it does so.

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* In 1969 Microsystems International Limited (MIL) was set up in an attempt to break into the integrated circuit field but it was abandoned after six years of operation.

Bell Canada also owns companies engaged in a variety of activities related to the telecommunication industry. Thus, it owns a directory printing company and an international consulting firm. In 1980, Bell established two subsidiaries for marketing terminal equipment: intelTerms Systems Limited for the sale of non-voice office equipment and Bell Communications Systems Inc. to market PBXs and KTSs.

B.C. Tel is also related by ownership to manufacturing and R&D companies. Its U.S. parent company, GTE, owns telecommunication manufacturing firms as well as operating telephone companies and has R&D facilities and specialized support corporations within its overall structure. In a recent reorganization, B.C. Tel purchased GTE Automatic Electric (Canada) Ltd. and its wholly owned subsidiary, GTE Lenkurt Electric (Canada) Ltd., from GTE International Incorporated, GTE's wholly owned subsidiary. CRTC approved this acquisition, which replaced the indirect link through GTE with B.C. Tel's direct ownership of its two major suppliers. Automatic and Lenkurt are firms which manufacture switching/subscriber equipment and transmission equipment, respectively.

CRTC also approved an application by B.C. Tel which essentially involved establishing a new research company. In October 1979, Automatic and Lenkurt were merged to form AEL Microtel Limited, which now owns 100 per cent of Microtel Pacific Research Limited, the R&D firm. AEL is the second largest telecommunication equipment supplier in Canada, surpassed only by NTL. Nevertheless, the combined sales of Automatic and Lenkurt in 1978 were $151 million, or one tenth of NTL sales for that year. Both companies, however, are tied in with production and R&D activities in the U.S.

The two major federally regulated telephone companies thus have integrated operating-manufacturing-research groups. A common argument advanced in support of the integrated group is that it provides the working environment necessary for a strong Canadian-based telecommunication industry.

## 5. Suppliers

Telecommunication equipment is now a sub-sector of the Canadian electronics industry. The various electronics industry sub-sectors - telecommunications, computers and office equipment, other communications, components, control and instrumentation, and consumer products - overlap. The continuing convergence of computer and telecommunication technologies results in an overlap of the first two sub-sectors, with a consequent erosion of traditional market distinctions. The "other communications" sub-sector relates to telecommunication in the areas of space communication and mobile radio equipment. Similarly, the "components" sub-sector produces items with telecommunication applications. This must be kept in mind when discussing firms active in telecommunication.

There were over 700 companies active in Canada in 1975 supplying electronic equipment. Only one firm, NTL, had annual sales in excess of $200 million in 1975, and only seven had sales of $50 million to $200 million for that year. Close to 500 had sales of under $1 million.

The Canadian electronics industry is characterized by a significant degree of foreign ownership. Of the 100 largest companies in 1975, 72 were foreign-owned. In total, some 20 per cent of the companies were foreign-owned. These collectively accounted for 55 per cent of the sales made by the industry. If NTL were excluded from the data, the foreign-owned companies would account for 80 per cent of the electronics industry's sales.

A high degree of international trade also characterizes the electronics industry. In Canada, the telecommunication sub-sector was the only one where imports were less than 40 per cent of domestic purchases in 1976 (18.6 per cent). Although imports exceeded exports for that year (by $6 million), this fact represented good performance relative to the other electronics sub-sectors with the one exception of "other communications", which had a positive trade balance.

Within the area of its specialization, NTL is the largest supplier in Canada. It also vies with GTE as the third largest in North America, both well behind Western Electric and ITT. Much of the latter's sales, however, are made from plants located in a number of countries in different parts of the world. Table 2, based on figures collected by the Department of Communications (DOC) from annual reports, provides a ranking of companies based on their sales of communication equipment. The ranking and absolute sales figures should be taken as providing a rough guide to the size or importance of the companies as telecommunication equipment suppliers, since the category "communication equipment" includes telecommunication equipment. Rockwell International provides an example of the care which must be taken. This company's participation as a communication equipment supplier is derived from its ownership of Collins Radio, which produces a narrow range of telecommunication equipment and cannot be compared to Northern Telecom in importance as a broad-based supplier to telecommunication companies or users. Rockwell's purchase of Wescom in 1980 helped to fill out that company's line of equipment but still left it unrepresented in the important area of central office switching. The figures do, however, serve to make the point repeatedly made during the inquiry that NTL, while large by Canadian standards, is of modest size by international standards.*

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* This argument is also sometimes made (and was in the DOC table) using companies' total sales figures. In the case of ITT, this means including sales by insurance companies, hotel chains and other diverse interests which it owns. Much depends on the ownership structure. Because GTE owns telephone companies, their sales are included. Western Electric, however, is owned by AT&T; thus the sales by its telecommunication companies are not shown; hence Western Electric appears as only marginally larger than GTE and smaller than companies such as ITT, Philips, Siemens and Hitachi. Similarly, can NTL's sales be considered independently from those of Bell, even though Bell no longer holds 100 per cent ownership of NTL?

## TABLE 2

### WORLD COMMUNICATIONS EQUIPMENT MANUFACTURERS WITH 1978 SALES* OF COMMUNICATIONS EQUIPMENT EXCEEDING $1 BILLION

| | Manufacturer<br>(In order of Communications Sales) | Communications Equipment Sales**<br>($ billion) | Base Country |
|---|---|---|---|
| 1. | Western Electric | 10.8 | US |
| 2. | International Telephone & Telegraph | 5.4 | US |
| 3. | Philips Lamp Holding Company | 4.4 | Holland |
| 4. | Siemens, AG | 3.1 | FRG |
| 5. | LM Ericsson | 2.4 | Sweden |
| 6. | Thomson-Brandt* | 2.2 | France |
| 7. | General Electric Company (UK) | 2.1*** | UK |
| 8. | General Telephone & Electronics | 2.05 | US |
| 9. | Hitachi* | 1.9 | Japan |
| 10. | Nippon Electric Company | 1.6 | Japan |
| 11. | Rockwell International | 1.5 | US |
| 12. | Northern Telecom Limited | 1.5 | Canada |
| 13. | Cie Générale d'Electricité | 1.4 | France |

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* 1977 data for Hitachi and Thomson-Brandt; 1978 data for all other companies.

** All sales are converted to Canadian dollars at the average exchange rate for 1977 or 1978.

*** Estimates. General Electric (UK) does not report net product group sales or intra-company sales.

# CHAPTER II

# TELECOMMUNICATION NETWORKS AND EQUIPMENT

## 1. Introduction

Telecommunications is the science and technology of communication by electrical or electronic means. The telecommunications inquiry conducted by the RTPC has involved a slightly more restrictive use of the term because certain types of telecommunication, such as commercial broadcast radio, are barely touched upon. When examining telecommunications it is useful, both technically and otherwise, to distinguish between the telecommunication network equipment required for the transmission and switching (or routing) of telecommunication signals, and the terminal equipment and systems of equipment in which telecommunication signals are originated and ultimately received. By distinguishing between these two groups of equipment, the technical and other arrangements for their connection may be isolated and analyzed. This in turn permits discussion of the terminal equipment and systems of equipment which may be connected to telecommunication networks. Technical aspects of this equipment and of connecting arrangements are presented in this chapter. Where appropriate, information about the remaining facilities comprising telecommunication networks is also presented.

Traditionally, voice-carrying telecommunication systems have been provided by telephone companies. These systems were "end-to-end", meaning that all the equipment, including telephone sets and other terminal devices, was provided by these companies. As well, the telephone companies and a few other companies provided recorded (i.e., printed) telecommunication services. Included in this group are telegraph, telex and TWX services. Because of advances in telecommunication, computer, electronic and other technologies, there have been significant changes in the nature, extent and scope of the telecommunication services being offered, or that predictably will be offered in the foreseeable future. The effects are also apparent in the equipment available to users of the telecommunication networks.

It is common within the industry to distinguish between the connection of terminal devices to an operating telecommunication network and the connection of equipment permitting an entire telecommunication system to operate in conjunction with the telephone network. Frequently, the first is referred to simply as "terminal attachment" and the second as "interconnection". As is discussed below, the definitional boundary between these two is difficult to maintain for a large amount of the equipment described.

The presentation is circumscribed in two significant ways. First, as its purpose is to facilitate analysis of the industry, it does not canvass the current state of knowledge of the physical phenomena underpinning telecommunication technologies. Second, due to continuing technical innovation together with institutional and other changes affecting the industry, it can be predicted that different applications of telecommunication networks (e.g., office of the future) will be developed and expanded in the future. Nonetheless, the information presented here is concerned with current applications. In consequence, the discussion of equipment used in conjunction with the operation of voice telecommunication networks occupies the largest part of this chapter.

After an overview of the constituent parts and operating features of telecommunication networks is presented, telephone sets, key telephone systems and private branch exchanges are discussed. Other types of voice-related telecommunication equipment discussed during hearings are then briefly presented. Included in this is a discussion of the interface between the above equipment and the telecommunication networks, with the analysis being broadened to include other-than-voice signals. Finally, there is a discussion of the equipment used in the provision of data, facsimile, textual and video telecommunication.

## 2. Telecommunication Networks

### a) Functional Constituents

Telecommunication networks consist of equipment and devices which may be described in accordance with three functions performed by these networks: the origination and reception of telecommunication signals carrying information, the transmission of telecommunication signals and the switching or routing of telecommunication signals from one transmission link to another.

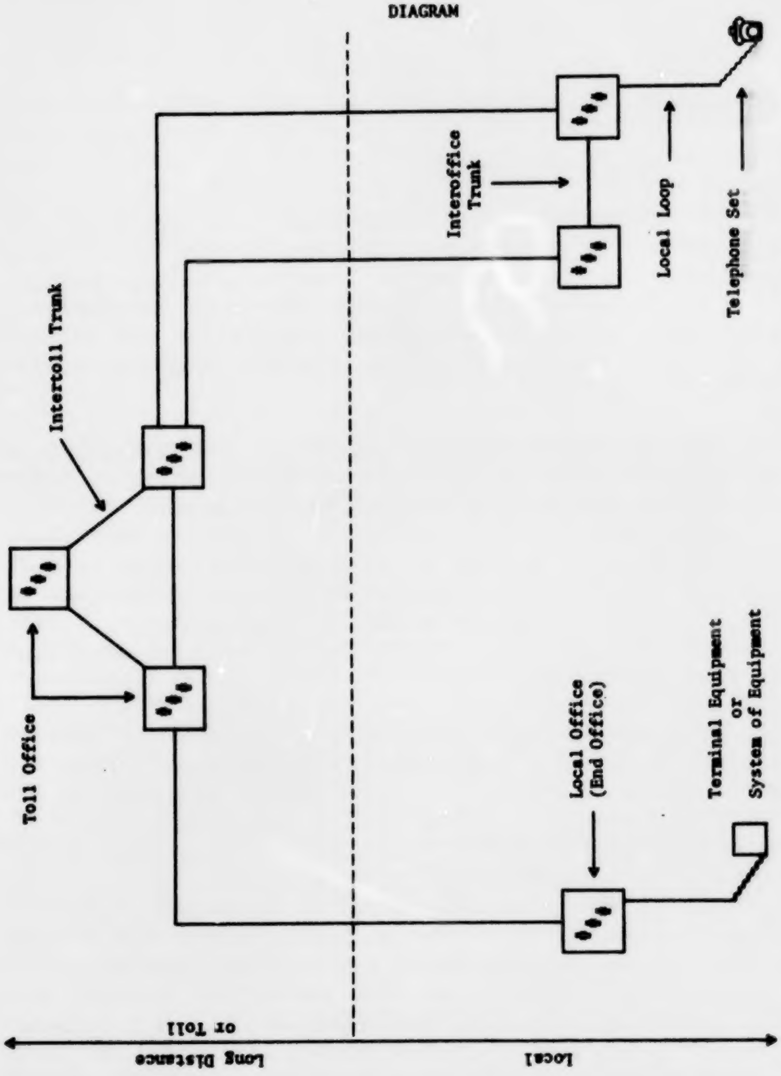
This equipment, its placement and the nomenclature used are illustrated in the following diagram, which is based on the equipment layout used in telephone networks.

The signals carried by a telecommunication network originate and terminate in terminal equipment, or systems of equipment, located at the end points of the network. Terminal equipment is sometimes referred to as station apparatus or subscriber apparatus.

Telecommunication signals are transmitted between two locations by means of transmission facilities. These facilities do not usually directly interconnect terminal equipment. Rather, transmission facilities carry telecommunication signals between terminal equipment and switching equipment, or between sets of switching equipment. As discussed below, switching equipment functions to establish temporary connections between different transmission facilities so that signals can be sent between specified terminal equipment for the duration of the connection. The connection between terminal equipment and switching equipment located with a telephone company is made by transmission facilities called "loop plant" and the facility joining a particular terminal device to such equipment is referred to as a "local loop".

Local loops serve as the point of entry for signals which are then transmitted through a network. When terminal equipment is located close together, such as in an area with a small population and in particular sections of more densely populated areas, the local loops associated with terminal

DIAGRAM


Long Distance
or Toll
Local
Toll Office
Intertoll Trunk
Local Office
(End Office)
Terminal Equipment
or
System of Equipment
Interoffice
Trunk
Local Loop
Telephone Set
Local Call Area 1
Local Call Area 2

equipment can be connected to the same switching equipment. When this is not the case, transmission facilities are required to interconnect different switching equipment. Network operators organize a hierarchy of switching equipment so that some switches interconnect other switches exclusively. Transmission facilities which provide connections between different switching equipment are called "trunk transmission facilities". In contrast to the method of transmitting signals over local loops, use of trunk transmission facilities generally involves the simultaneous transmission of the signals originating from numerous terminal equipment.

In any telecommunication system, the transmission facilities are a composite of individual transmission links. As links, these facilities provide the means to move signals from one location to another. Switching equipment is used to connect, temporarily, two or more transmission links. In this way, routes are established between two or more terminals.

There are two fundamental techniques for the transmission of telecommunication signals. Such mediums as wires, cables, coaxial tubes or, recently, optical fibers can guide the signal. Alternatively, or conjunctively, the signals may be propagated through the atmosphere or space. Microwave relay facilities, satellite systems, mobile telephone connections and radio-paging systems illustrate this second technique.

Switching equipment performs the function of establishing connections among various transmission facilities so that, ultimately, the requisite transmission paths are formed, enabling an originating signal to be transmitted to a specified location. This function is easiest to visualize by reference to a manual switchboard where the operator acts on verbal instructions to establish the desired linkage. The locations of, and operating features provided by, switching equipment used in networks are hierarchically organized. Three general levels of switching equipment are evident in the hierarchy. These are: the network user's switching equipment, usually located on the user's premises; the local switching equipment which provides connections for transmission facilities located within defined toll-free areas such as cities and towns; and toll or long-distance switching equipment used in conjunction with transmission facilities connecting geographically separated areas.

Switching equipment is located on a user's premises when there is a sufficient requirement for interconnecting terminal equipment located in the same area (within a building, for example) or in a limited number of locations (in separate branches of a commercial establishment, for example). In the telephone network, local and toll switching equipment are situated in local and toll offices, respectively, of telephone companies.

### b) Network Operation

Information is transmitted through telecommunication systems in the form of electromagnetic waves, phenomena which include electricity, light and radio waves. Not only are there different techniques and technologies by which electromagnetic waves can be utilized for telecommunication, but also, given any technique or technology, choices can be made as to the design and engineering of the system. In consequence, the signals which are to be transmitted in a particular system are required to conform to standards dictated by the design of the equipment comprising the system.

The signals from terminal equipment are required not only to be of a form which can be transmitted by a telecommunication system but also of a form which will not cause disruption in the operation of the system. Similarly, equipment forming the interface between a telecommunication network and terminal equipment is required to safeguard network standards. Not only must the electromagnetic characteristics of the different signals be compatible with the equipment and facilities of the system, but the various devices must be physically compatible also. In order for the various parts of the system to function together, the controlling signals and other operating aspects of different equipment also must be compatible.

## c) Types of Networks

There is a variety of telecommunication systems. The most extensive, and the ones carrying most of the Canadian telecommunication traffic, are those operated by the telephone companies together with those operated by Canadian companies providing telegraph and teletypewriter services. Voice traffic is the dominant type of telecommunication, although data and other types of telecommunication traffic account for a significant and relatively fast-growing proportion of all traffic. Because of their predominant position in Canada, the networks of the telephone companies receive the largest part of the attention below.

Telephone networks are usually referred to as public switched networks, i.e., any user can gain access to any other user. Associated with the operation of public switched networks are private connections. The equipment and facilities here, though similar to, if not identical with, the equipment of the public switched networks, are distinguished in that the group of terminal devices through which access can be gained through private connections is restricted. It is in this sense that these facilities are private rather than public. If two devices are permanently connected together, the connection is a dedicated rather than a switched one. The term "dedicated" is also applied to telecommunication facilities provided exclusively for particular groups of users, as opposed to all users of the networks.

Telecommunication systems may also be distinguished by the type of signal which they can carry and by the degree to which the systems are specialized to a particular type of signal. Telecommunication systems, or various of their constituent parts, can be designed to carry signals in either an analogue format or a digital format. The traditional format of telecommunication signals has been analogue. Analogue signals are characterized by the continuous range of values which the signal can display in terms of its measured amplitude and duration in time. With technical advances in electronics and closely related changes in telecommunication system users' demands, the development of telecommunication equipment handling signals in a digital format has proceeded quickly in the 1970s and it is being installed increasingly.

Digital format characterizes not only new systems but also the replacement of portions of existing telecommunication systems, including portions of the telecommunication networks operated by telephone companies. In contrast to analogue signals, digital signals are discrete with respect to both the values the amplitude of the signal is allowed to assume and the duration of the signal. Insofar as the present inquiry is concerned, digital signals can be identified with the use of binary coding of information so that the digital signals being carried in a telecommunication network represent strings of the numbers 0 and 1. Although the use of digital and analogue signal formats distinguishes the operation of analogue and digital telecommunication systems, or portions of these systems, any signal which is in an analogue format can be transformed into a digital format, and conversely. Nevertheless, it remains that the equipment in the field is predominantly analogue and will continue to be so for the next few years at least.

A distinction is made not only between signals in accordance with their format but also, frequently and appropriately, in accordance with the service application provided. Thus, different types of signals are involved in systems providing voice services, the distribution of cable television signals, and data, textual and facsimile services. In view of the fact, however, that signals for one service application can frequently be transformed into a form appropriate for another application, it is apparent that the characteristics of the electromagnetic waveform for which a particular system is designed are critical in determining which applications a network is capable of providing.

Of these characteristics, it is the bandwidth of the electromagnetic waveform which is salient. Some specialized systems, such as the ones designed for telex or TWX signals, have a smaller signal bandwidth capacity than systems designed to carry voice conversations. Similarly, systems designed to carry video signals have higher bandwidth capabilities than those designed for voice conversations. As well, systems capable of sending larger amounts, or a faster rate of digital information are also characterized by greater signal bandwidth capabilities. Telecommunication systems designed for service applications which require larger signal bandwidths can also carry those telecommunication signals requiring a lesser amount of bandwidth, if those signals are in an appropriate form. Consequently, telex and other low-speed data telecommunication signals can be carried on systems designed for voice conversations, but not conversely. A system carrying a video signal can carry a voice conversation, but not conversely. Alternatively, a system having a greater bandwidth capability may use that capability to carry simultaneously more than one telecommunication signal of a type which requires only a fraction of the bandwidth. In this way, for example, the telecommunication networks operated by telcos are capable of simultaneously carrying a video signal and a number of voice conversations.

Although the bandwidth capacity of a telecommunication system is of salient importance, there are other factors which must be considered when attempting to classify a system as to the degree of its specialization. The telecommunication systems operated by cable television companies are illustrative. These systems have a large bandwidth capacity but lack switching and other equipment so that they cannot be used as a public switched network, at least as they exist today. Further insight into the operation of telecommunication systems in Canada may be gained by turning to the variety of equipment which can be connected to networks.

## 3. User Voice Equipment

Among the various types of end-user equipment available for voice communications, the telephone set is easily the most common. In discussing telephone sets, a distinction can be made between those which are connected to a single telephone (transmission) line, as are most of the telephone sets installed in residences, and those which are connected to a multiple of telephone, and perhaps other, telecommunication transmission facilities. These multi-line telephone sets not only have all the features found with a single-line set, but also additional features which increase the range of telecommunication functions available to the user of that set.

In some cases, conjoining equipment to the telephone set results in the providing of additional functional features. Among the types of equipment required to provide these features are key telephone systems (KTSs) and private branch exchanges (PBXs). With each of these, the telecommunication system located on the user's premises includes a number of telephone sets and it is this system, the group of telephone sets together with the additional equipment, which may be considered as connected to the facilities of a telephone network. Single-line telephone sets, KTSs and PBXs are discussed separately in the following subsections.

a) Telephone Sets

There are six functions performed by the components of a single-line telephone set: 1) conversion of sound waves to electromagnetic waves (signal origination); 2) conversion of electromagnetic waves to sound waves (signal termination); 3) signaling the switching equipment; 4) responding to signals from the switching equipment; 5) optimizing signal properties to meet certain performance standards; and 6) sending the address of the terminal equipment with which a connection is required. The power source for the operation of the components is, under current practices, external to the telephone sets. There are power sources at the central office and, in the case of PBXs and KTSs, on the users' premises.

The first two functions are performed by components located in the telephone handset; these components are called the transmitter (mouthpiece) and the receiver (earpiece) respectively. In the past, the transmitter has operated when sound waves caused a diaphragm to vibrate and in consequence altered the electrical properties of carbon granules located in a capsule attached to the diaphragm. This systematic alteration in turn prompted an electrical current to pass through the carbon so that information (i.e., the voice conversation) was carried by the electrical current. Because of technical advances, this type of transmitter, called a "carbon-transmitter", can be replaced with electronic transmitters. Receivers function in a manner similar to speakers in radios. Again, the components comprising a receiver are changing because of technical advances in the area of electronics.

The third function is performed by a telephone set when the handset is picked up or replaced on the body of the telephone set. This activates a hookswitch which signals controlling equipment, by a change in the electrical current flowing through transmission facilities, that a call is about to be made, or has been terminated. The fourth function is the response to a signal from controlling equipment, the response being the ringing of the telephone set's bell or ringer, which in turn signals the user that there is an incoming call. Again, technical advances in electronics permit the replacement of the traditionally used mechanical bells by electronic devices which emit tones to indicate an incoming call.

The fifth function is performed by electrical circuits within the main body of the telephone set, which collectively are called the "electrical network". To ensure that certain signal performance parameters are met, this network performs a group of functions. This includes, for example, a limited amount of compensation for the effect which various transmission facility links can have on the attenuation of telecommunication signals over longer transmission facilities. The electrical network also interconnects the receiver, transmitter and the transmission facilities so that a two-way conversation can proceed. Here, also, electronic components are replacing more traditional ones.

The sixth function is performed with the use of a rotary dial or a push-button dial. The first type of dial transmits the address of the terminal equipment being called, by generating electrical pulses. A rotary dial operates to open and close a switch which causes an electrical current, or pulse, to be sent along the transmission facilities. The number of times the switch is opened and closed, and thus the number of times electrical current flows out along the transmission facility, corresponds to the digit or number being dialed.

The push-button dial uses various combinations of audible tones to transmit this same information. Tones of different frequencies are generated when the buttons assigned to different digits are pushed. These tones transmit the digits of the number being called to controlling and switching equipment.* In a touch-tone dialing mechanism, any button generates two tones, one associated with the column in which the button is located and one associated with the respective row. The resulting combined tone is transmitted along the transmission facility to other equipment which, on reception of the tone, can interpret which digit has been dialed. It was the development of solid-state devices which permitted the generation of tones by components internal to a telephone set.**

The two extra buttons usually found on a touch-tone pad can be used to provide other functions if componentry is added to the telephone set. With advances in technology, it has become possible to incorporate additional features on the single-line telephone sets. An example of this is the feature of speed-dialing, wherein the pushing of two or three buttons will result in the telephone automatically dialing a preselected seven-digit telephone number. Another example is componentry which is capable of storing the last number dialed for automatic redialing when the user selects this feature.

Electronic telephone sets, or e-phones, have been discussed on various occasions throughout the inquiry. The adjective "electronic" refers to two distinct types of change in the design of telephone sets. With one type of change, the traditional components are replaced by electronic devices: the transformer-coupled speech network and the internal parts of the push-button dial are replaced by integrated circuitry, and the carbon-granule transmitter is replaced by an electronic transmitter or transducer. Similarly, the electromechanical bell-ringer can be replaced by tone generating electronic components. The other type of change in a telephone set which the term "electronic telephone" may refer to is related to the inclusion of electronic componentry in the telephone set itself so that features in addition to the traditional ones may be available to a user. The electronic components associated with this type of change would include electronic memory devices and microprocessors located within the housing of the telephone set.

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* There is also a dialing mechanism which has touch-tone buttons but transmits the dialed numbers as pulses. This enables the use of touch-tone pads with switching equipment not able to receive these audible tones.

** The tones used have been standardized across North America by the telephone companies.

It is these components which allow the user access to features such as speed-dialing and automatic redialing of the last number called, as well as allowing the telephone set to be used in a number of applications other than the traditional voice conversation application. Automatic fire alarm systems and security systems, for example, may be installed by using enhanced features found on electronic telephone sets. An electronic telephone set is not a prerequisite for the provision of enhanced features, however. Similarly, with additional electronic componentry, the telephone set may be used to receive and transmit data signals for a variety of applications.

The telephone sets which have been described thus far are attached to other equipment in telecommunication systems by means of single transmission facilities. In the telephone networks, the single-line telephone set is electrically connected to a transmission line which extends from that set to other local distribution facilities, and from there to a local central office containing switching equipment. The electrical circuit from the telephone set to the local switch is the sole path by which the user of a single-line telephone set can achieve a connection with another telephone set, or any other terminal device connected to the network. This is usually the type of telephone set found in a residence, but may also be found on business premises. Similarly, single-line telephone sets used in systems other than the public switched networks operated by telephone companies are connected by means of a single transmission line or facility.

### b) Key Telephone Sets and Systems

Telephone sets may also permit access to more than one transmission path into a network. The telephone sets which permit this are called multi-line sets and, traditionally, this access has been accomplished by physically attaching multiple transmission facilities to the telephone set. Recent advances in electronics have permitted a telephone set which is attached to a small number of wires ("skinny wires") to have access to the same number of paths into the network.

Operation of multi-line telephone sets requires componentry in addition to that previously described. Buttons on the main body of the telephone set permit the user to select one line from those accessible. These buttons switch the telephone set's electrical connection from one transmission facility to another. The buttons are referred to as keys and these are separate from the dialing mechanism. Such a telephone set is frequently called a "key telephone set". Whereas key telephone sets can be used solely for the purpose of obtaining access to one of a number of transmission lines, frequently the keys are also used to provide further features, such as intercom and line hold. Often, the provision of further features requires equipment external to the telephone set to support the operation of the telephone set, permitting limited switching and controlling functions to be performed on a customer's premises. The key telephone set together with this additional equipment is called a "key telephone system" (KTS). KTSs, as well as other specialized on- premises equipment (e.g., PBXs) have been classified by the telephone companies as subscriber switching equipment and not terminal equipment.

The central or control equipment to which the telephone sets are connected is used to initiate ringing, to place lines on "hold" and to operate (and power) the illuminated push buttons. Recent technical advances have enabled additional features to be available with KTSs, as microprocessors and other electronic equipment can be located in the controlling equipment as well as in the telephone set. Sophisticated programmable KTSs have been introduced which include features previously associated only with PBXs. Thus, the technical distinction between KTSs and PBXs is changing, if not being eliminated.

Key telephone systems can be used where there is a requirement for from two to more than 50 telephone sets. Requirements for more telephone sets are provided by the PBX equipment which is discussed later. There is overlapping between the number of telephone sets and the number of lines that can be served by KTSs or by PBXs since premises where less than 20 lines are installed can also be served by PBXs. Also, KTSs can be used together with PBX equipment so that a KTS is connected to the PBX rather than directly to the facilities of a telecommunication network.

The configuration of equipment comprising a KTS can vary and there are a number of different types of telephones which are associated with KTSs. These telephones can have, for example, two, six, ten, or more buttons. Each telephone set may permit access to all the transmission lines to which the KTS is attached, or to a smaller number. Similarly, access to any particular line can be shared between a number of the telephones of the KTS.

There are many features usually associated with a KTS though not all of these are necessarily found on any particular installation. In addition to the capability of selecting alternate lines by pushing a button (called a "line pickup" feature), KTSs can enable the user to maintain or hold an established connection while switching the connection of the user's set to another line. This feature is called "line hold". Illuminated push buttons, indicating which line is being used by another set related to the KTS and which call is awaiting, constitute another feature. An audible ringing signal is another optional feature. An intercom feature, whereby after pushing the appropriate button any other telephone set of the KTS can be dialed by use of one or two digits (depending on the size of the KTS), is also common.

There is a further set of features which may be found on some KTSs, particularly on newer equipment. Some features, such as an automatic dialing feature or a handsfree speakerphone, are provided by componentry added or connected to the telephone set or included within the housing of the telephone set. Features provided by these means are independent of the central KTS equipment and can also be provided on single-line telephone sets and PBX systems. Other features, such as the capability to connect more than two telephone lines together ("conferencing") and the capability of loudspeaker paging, require appropriate design of that part of the KTS external to the telephone set. Here again technical advances are expanding the features available to users of KTSs. A comparison of specific equipment and the associated features available will be presented later.

Until recently, the connection of the different telephone sets of a KTS to the centrally located equipment on the user's premises was made by means of cable containing a relatively large number of pairs of wires (e.g., 25 pairs), each wire pair representing a transmission link. Application of current developments in electronics to KTSs has recently resulted in the introduction of cables having only two or three wire pairs, without a reduction in the number of transmission links accessible from individual telephone sets.

### c) Private Branch Exchanges

Multi-line telephone sets can also be connected to private branch exchange (PBX) equipment, as can single-line telephone sets and KTSs. PBX equipment is generally located on the user's premises. In the systems operated by telephone companies, PBX service is sometimes provided under the name "centrex". With these systems, although the user receives PBX service, the switching equipment is located with the telephone company. PBX equipment also provides access to features which, in most cases, would not otherwise be available. Because of changes in the available technology, features more traditionally associated with PBXs are becoming available on other equipment.

With PBXs, electrical and signaling functions are performed on the user's premises as well as in central office equipment. Also, with this equipment to a far greater extent than with KTSs, the switching function is performed on the user's premises. In both cases, however, the locale of the switching equipment is explained in terms of a user's internal pattern of message traffic, a pattern which would suggest that it may be more economic to substitute PBX equipment for some of the longer transmission facilities connecting the user's terminal equipment to relatively more complex and more distant switching equipment. A PBX system also enables the user to connect each of a multiple of telephone sets to a group of external lines.

PBX equipment is too complex to describe and classify in terms of one characteristic. Rather, four characteristics - switching technology, control technique, line size and features or applications - are required to discuss and distinguish the various PBX products. These four characteristics are not independent of one another, as discussed below.

The switching technologies and controlling techniques incorporated in PBX equipment parallel those found in the switching equipment located in the central offices. There is a significant difference in scale, with PBXs generally being smaller than other switching equipment although the larger PBXs are similar in size to the smaller central office switches.

Switching equipment is used to provide temporary connections among various transmission facilities, connections which, ultimately, establish a route between terminal devices over which the signals can be transmitted. The alternative to this is the permanent interconnection of terminal devices which, in any system having a large number of terminal devices, would require the installation of an enormous amount of transmission facilities. Instead, various technologies have been used to make the requisite temporary connections among different transmission facilities.

The switching function can be performed either manually or automatically. With manual switching, an operator at a switchboard responds to an incoming call, obtaining the number, or address, of the telephone set, for example, to which a connection is being requested. The connection is established by the operator who physically plugs the appropriate wires into the switchboard. Once the communication is over between the users of the terminal equipment, the operator manually unplugs the connection previously established. With automatic switching, the operator is replaced by electrical or electronic equipment.

Automatic switching technologies may be grouped into two distinct categories: those that utilize space division switching (SDS) and those that use time division switching (TDS). With SDS equipment, a specific path or circuit in the equipment can be identified with the route followed by signals in their passage from one terminal device to another. For example, the switches, or cross points, providing the interconnection of transmission facilities are identifiable and distinct for every connection.

With TDS equipment, advantage is taken of the capability of electrical and electronic equipment to store signals in memory devices and, at the appropriate time, to release the signals to continue their progress through the system. By associating the signals emitted by different terminal devices with different periods of time, the same switching circuit can be used to direct different signals to different transmission facilities and, ultimately, different terminal devices.

SDS technologies can be divided into those in which electromechanical switches are closed to establish a path (circuit) through which a signal passes, and those in which solid-state devices are used to establish electromagnetic paths. Among the electromechanical switches are step-by-step (SxS) switches, crossbar switches and reed relay switches. This is the chronological order of development, with solid-state devices having been developed more recently. Switching systems using SxS switches require that a series of SxS switches, each associated with one digit or number of the terminal device to which a call is being made, be closed before a route through the switching equipment is established. Crossbar technology involves a considerably smaller amount of mechanical movement of components to establish a path. In this equipment, the connections between incoming and outgoing transmission facilities are arranged in a grid or matrix pattern and the electromechanical movement of metal bars results in the establishment of a point of physical contact between a horizontal and a vertical bar, and thereby a path. With reed relay switches, the grid pattern of switching points is retained but the metal bars are replaced by relatively small relays, each located at the point where two bars would otherwise be in contact. The opening and closing of these small relays break and establish the appropriate paths. The electromechanical motion required for the operation of reed relays is significantly less than that required with crossbar technology.

Solid-state switches are also arranged in a grid pattern but do not involve mechanical movement. Instead, electronic gates are used. The gates are composed of electronic circuits having electrical properties which can be altered by equipment controlling the switching equipment. By altering the electrical properties of an element of a gate (e.g., a transistor), the gate can be made to allow a signal to pass through it, or made to prevent such a passage. That is, a gate can be turned off and on, or be opened and closed.

Equipment incorporating TDS can be separated into two groups: that operating with analogue modulation techniques and that operating with digital modulation techniques. In the former, the amplitude or width of the pulse is modulated (PAM or PWM). In the latter, continuous values are divided into ranges and coded (PCM and delta modulation).

Thus far, the discussion has concentrated on the technique used at the point where a switch operates. In any particular switching product, the individual switches are arranged to work as a unit. The structure or architectural organization of the switches differs among PBXs. Some switching equipment uses the same type of switching technology throughout, whereas other products incorporate a mix of technologies, most commonly a mix of TDS and SDS techniques. There are other differences as well.

Control equipment is required to initiate sequences resulting in the opening and closing of the appropriate switching points, to monitor the state (idle or busy) of transmission facilities, to initiate the sending of a dial tone or busy tone when appropriate, and so on. There are several ways in which this equipment has been designed to operate. Some of the different control techniques can be associated with the chronological development of the switching technologies outlined above.

SxS switches, which were the first of the switches discussed herein to be developed, are closed sequentially so that a transmission route through the switching equipment is progressively established. In the early days of usage, each switch was associated with specific controlling equipment. As telecommunication techniques developed, registers (memory devices) began to be introduced and with this development some of the controlling equipment was shared by a number of switches. In crossbar switching equipment, an entire grid of switching points is controlled by common facilities, a method called "common control".

The common control switching equipment can directly establish a connection between incoming and outgoing transmission facilities. This eliminates the hunting sequence of SxS systems where each digit of the number dialed required an additional switch to be closed, a circuit which the controlling equipment had to search or hunt for. The common control design is retained in reed relay switching equipment.

The common control equipment was electromechanical in nature when first applied in telecommunication but now is being replaced by electronic devices. Furthermore, although initially hard-wired, these electronic devices can now operate with the use of (programmable or software-based) stored programs. These systems thus operate under stored-program control (SPC). The advantage of SPC over hard-wired control equipment lies in the relative ease with which the stored programs can be altered. The introduction of new features, for example, would thereby be facilitated. The scale of the information processing equipment varies with the size of the switching equipment in question, and with increasing size varies from a microprocessor to a mini-computer or to a computer, for example.

With SPC equipment, the matrix of switching points may remain electromechanical or may be replaced by electronic switches. All the switches discussed to this point are SDS switches. With the use of more electronic and common control or SPC equipment, it is also feasible to perform the routing function using TDS techniques. Technical advances have also permitted the dispersement of controlling equipment functions among different devices - distributed common control.

A third descriptive characteristic of PBXs is the volume and pattern of traffic for which PBXs are designed. This aspect of design is frequently summarized as the line-size range of the particular PBX, and roughly refers to the number of transmission links, to both terminal equipment and central office switching equipment, which can be connected to the PBX switching equipment. For every PBX, there is a maximum amount of signal traffic and a maximum number of telephone set lines and (central office) trunks which can be operated simultaneously. This is a design limitation and sets the upper limit on the size range of the PBX. The lower limit is set by cost considerations related to the common control and other common equipment used in the operation of the PBX. PBXs are designed for different scales of traffic volume and patterns and incorporate different scales of information processing equipment, different amounts of signal distribution facilities, and so on. Although cost considerations limit the applicable size range of PBXs, PBXs having different line sizes but manufactured or designed by one company may share design concepts. The particular line sizes of the PBX products currently marketed are discussed later.

The last characteristic used to delineate different PBXs is the array of features offered. There are numerous features available on different PBX products and not all features can be obtained on any single PBX. Because of the large number of features* on modern PBXs, only the most important are presented below.

PBX features can be placed in one of two groups: PBX system features and PBX user (or station) features. System features include those operations performed by the central PBX equipment, and PBX user features include those operations which an individual has access to or may select to use. In addition to the above distinction, some PBX applications are reserved for specific types of users and are distinct from general business applications. These applications will be discussed separately.

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* A witness from Northern Telecom stated that there were approximately 400 features available on PBXs.

Among the PBX system features available are route optimization and toll restriction. Route optimization operates to select automatically from among a number of types of toll facility (e.g., DDD, FX and WATS) the least expensive available connection or, if desired, to prevent specified toll connections from being made until a particular toll facility is available. The individual user does not control this feature: the system - the equipment - does so automatically. The toll restriction feature automatically prevents certain connections to the system from being accomplished from specified telephone sets. Both of these system features are marketed to business users as features which will allow them to control and minimize their costs. Similarly, the system feature, "call detail recording" (CDR), is one which provides the user with a detailed listing of communication activities (e.g., time of call, caller and calling number, duration of call, and so on). Again, this feature is marketed as a means whereby a PBX user can identify and monitor individual usage and thereby contain costs.

In addition to these, there are other system features, under the control of central equipment, which automatically re-route or hold incoming calls. A call queueing feature can place an incoming call on "hold". Another type of system feature concerns the actual operation of the PBX system more directly. Examples include the capability of a PBX to undertake and store diagnostics, the availability of a redundant source of power in case of a failure of the commercial power source, and the method by which a telephone number may be reassigned among the telephone sets.

There are many features which can be associated with the specific user. Examples include speed-dialing or abbreviated dialing, automatic redialing of the last number called, "on-hook" dialing, etc. These features are accessible to a particular user when desired and are not selected automatically by the PBX system. Special telephone sets are sometimes available with PBX systems to provide other features. An example of the type of feature that can be made available in this way would be a light-emitting diode (LED) display which can indicate the elapsed time on an outgoing toll call, as well as other information.

PBXs designed for hotel/motel applications provide features such as "wake-up" services, "message-waiting" signals, administration information about telephone usage, and so on. "Automatic call distribution" (ACD) is another example of a PBX feature useful to other businesses. ACD distributes incoming calls made to one number among a group of telephone sets. This would be used in organizations where many incoming calls originate for similar purposes, purposes not dependent on the particular individual receiving the call. Airline companies, for example, use ACD in the operation of ticket reservation systems. Another specialized PBX application is represented by the "centralized attendant service" (CAS) feature. Multi-location retail stores, for example, use CAS to route all incoming calls first to a central location and then on to one of several physically dispersed locations. A final example is a multi-customer or multi-tenant PBX application which permits several separate users to share the central PBX equipment and so gain access to PBX features when users individually would not be able to justify exclusive use of a PBX.

Some features offered on PBX equipment may also be obtained through the use of specialized, non-PBX equipment. "Route optimization" and CDR are two examples. Economic and other information about these alternatives is presented elsewhere in this report.

## 4. Connection of Equipment to Telecommunication Networks

### a) Digital and Non-voice Equipment Applications

The previous sections have dealt primarily with equipment which may be connected to voice-signal, analogue telephone networks. The equipment may also provide a method whereby the telephone network may be used for non-voice communications purposes. The transmission of non-voice information requires the transformation of the non-voice signals into a form conforming with the operating requirements of these networks, i.e., be made similar, in their electronic version, to voice signals. This transformation is accomplished by the use of equipment connected with, or incorporated into the design of, terminal equipment or systems of equipment which are ultimately connected to the facilities comprising telephone networks.

Telecommunication networks other than telephone networks, such as telegraph, telex and TWX, are commonly called "record services", as the received messages are in printed or record form. As with telephone networks, the facilities of these networks are designed to the particular requirements of the signals used.

Included in the design of traditional analogue telephone networks are parametric considerations related to voice communications. For example, the local loop facilities are designed around the amount of electromagnetic frequency spectrum required to carry single (two-way) voice conversations. Non-voice signals may be sent over these local loops, or the equipment on the loops and trunks, designed to improve voice transmission, may be removed to allow higher rates of transmission. For higher speed transmission than is afforded by local loops, leased lines are available from telcos. Networks designed for other types of message traffic (e.g., data) are also tailored to the particular characteristics of the signals carried.

At one time, the services provided by the different types of network, if not complementary, were at least imperfect substitutes. Technical developments and advances in computer technologies, telecommunication technologies and electronics since roughly the 1950s have resulted in an increasing expansion of the variety of signals carried by the different networks. This trend has progressed to the point where the possibility of using a single type of network for a large array of applications has received serious discussion. This possibility does not, however, exclude the feasibility of more specialized networks, or of a multiplicity of similar but independently operated networks.

At present, there are three broad trends, the technical nature of which are relevant here. First, equipment manipulating diverse types of information is increasingly being connected with the telecommunication networks. Perhaps the most obvious of these are equipment and systems of equipment used in data (e.g., computer) and video (e.g., television) applications. Facsimile and textual applications, as well as applications combining two or more types of signal, such as word-processing equipment and video-text equipment, are becoming more common. Furthermore, within each type of application, there has been developed an increasing variety of particular forms of signal. For example, signals carrying data or digital information are distinguished not only by their digital format but also by the different rates of transmission used.

The second trend, related to the first, began with the introduction of equipment operating with digital telecommunication techniques. One consequence is the requirement for equipment such as digital telephone sets which can digitize voice conversations, that is, transform analogue voice messages into a form appropriate for transmission through the facilities designed for digital telecommunication techniques. The transformation shares technical attributes common to the transformation of non-voice signals into a form appropriate for transmission through the traditional analogue telephone networks. Another technology related to this is the use of optical techniques for signal transmission.

The third trend, paralleling the first two, has been the development of telecommunication networks operated primarily for non-voice applications (e.g., Datapac, Infoswitch). Both the terminal equipment and systems of equipment connected to these networks, as well as the use of digital techniques, are progressing in step with developments affecting the design of the telephone networks.

The signals originating in equipment connected with the facilities of telecommunication networks are required to have characteristics conforming to the design parameters of these networks. When the equipment originates telecommunication signals of different types (e.g., voice, data, facsimile, textual, video), the signals must be converted into the appropriate format through additional circuitry.

The type of equipment necessary here may be illustrated as follows: modems (MOdulator/DEModulator) or data sets are devices which transform originating signals from a digital format to an analogue format for transmission in telephone networks and retransform the signals, on reception, back to their original form. Similarly, codec(s) (COder/DECoder) are used to perform analogue-to-digital transformations and enable voice conversations to be carried through equipment which operates with digital signals. With the use of these devices, or devices having a similar function, all manner of telecommunication signals may be transformed into a format suitable for the particular telecommunication network through which the signals are to be transmitted. Again, the signals in the appropriate format must conform to the operating specifications of the network.

As is the case with connecting arrangements, the appropriate equipment for transforming the format of telecommunication signals may be designed into the terminal equipment or system of equipment under consideration, or may be physically separate. In either case, this equipment may be incorporated with the connecting arrangement itself.

### b) Methods of Connection

Equipment can be connected to the facilities comprising a telecommunication network by acoustical arrangements, by direct and by indirect electrical arrangements. A fourth possibility, involving optical arrangements, is not applicable to the types of telecommunication facility discussed in this section. The most common connections for common voice equipment, teletypewriters and for much of the data equipment in use are direct electrical arrangements.

In a direct electrical connection, the circuitry employed permits electromagnetic signals, or electricity, to pass directly into the facilities of the telecommunication network. Similarly, electromagnetic waves can pass in the opposite direction.

Acoustical connections are also sometimes used for data equipment which emits audible tones. These connections are accomplished by placing the telephone handset in a cradle so that it is physically close to the point from which the audible tones emanate. This allows for good reception by the telephone receiver and prevents the contamination of the signal with unwanted noise in the vicinity.

Any equipment which is to be connected to a telecommunication network, and which itself works with electromagnetic signals, may contain componentry for transforming these signals into sound waves. The sound waves so generated are then capable of being accepted by the transmitter portion of the telephone handset, reconverted into an electromagnetic form, and transmitted through the telecommunication network. Conversely, audible telecommunication signals emanating from the receiver of the telephone handset may be accepted by componentry in the equipment which is connected to the telecommunication network.

In an indirect electrical connection, the circuitry of the equipment being connected to a telecommunication network, and the circuitry of the relevant facilities of a network are isolated at the point of connection with changes in the electrical characteristics of the electromagnetic signal on one side of the point of connection inducing corresponding changes in the electromagnetic signal on the other side, and conversely. Examples of indirect electrical connection did not arise during the course of the inquiry. However, it appears that such connections may have been important in the protective arrangements, discussed later, used to safeguard the network.

Primary technical concerns raised are related to the potential effects of connected equipment on the operation of the network. These concerns are related not only to the effects when initiating a connection, but also to potentially deleterious effects which may commence at a later date resulting from deterioration in the connecting arrangement or the connected equipment.

Electrical compatibility of connected equipment requires first, that the electrical characteristics of the signals originating from the connected equipment conform to the design of the network to which the equipment is connected and second, that safety-related and operational aspects of the connection, such as the potential for electrical leakage, be strictly monitored.

Non-network-addressing equipment does not have the capability of dial-pulsing or push button signaling control, whereas network addressing equipment transmits signals which will cause equipment located in telephone company central offices to establish a route through the telephone network to other terminal equipment. The technical issue raised here relates to the control of various facilities within the network.

Where subscriber-provided apparatus is allowed, the numerous possible connection points raise a question about where the public network ends and the subscriber's portion begins. The location of connections is certain only in the case of acoustical arrangements, since they are associated with the handset portion of telephone sets. Electrical connections, however, can occur at almost any point on the wiring within a subscriber's premises ("inside wiring"). For example, several features provided by modern PBXs and KTSs are also available from separate equipment provided on a stand-alone basis, and ownership of the various pieces of equipment may be divided between the telco and the customer.

Moreover, the operation of computer facilities may involve a combination of network facilities provided by telephone companies or other carriers, and other private telecommunication facilities. In this case, equipment may be used which not only interconnects the telecommunication and computer systems but also addresses both. The evidence of the Canadian Business Equipment Manufacturers Association Inc. (CBEMA) indicates there is some dispute as to where the boundary between computer facilities and telecommunication facilities is defined. As part of this, there is some dispute as to the definition of what constitutes computer terminal equipment (when connected with a telecommunication network) and what constitutes telecommunication terminal equipment (when connected with a computer system).

### c) Protective Arrangements

Telephone and other networks are designed and engineered to carry signals having electrical characteristics which fall within specified limits. The power or strength of these signals, the electromagnetic frequencies used, and other characteristics of the signals are required, at the point at which they enter the facilities or telecommunication networks, to conform to restrictions inherent in the design of the particular network. The restrictions are to ensure three objectives. First, signals are required to meet standards of clarity so that the informational content is received and not lost or degraded beyond acceptable levels. Second, signals between locations must not interfere with other signals. Third, because various types of equipment used in the operation of networks are controlled by means of specific signals, both the operation of any equipment connected to the facilities of the network and the form of the signals carrying information between terminal equipment are required to be compatible with, and not disrupt, the use of these signals.

A second set of restrictions, directed toward safety-related and operating aspects of the connection, represent an attempt to control potentially hazardous voltages and electrical surges. There are alternative ways to prevent, or minimize, the occurrence of potentially adverse technical effects. One method is to ensure that the componentry of the equipment being connected corresponds with the requirements of the network, that is, that the equipment meets certain standards. Another is to employ connecting arrangements which are designed so that only signals of the appropriate form are passed. Thus, filters may be employed to eliminate signals of the type used to control network equipment or to attenuate signals which are too strong. An interface device, a coupler, may be used in direct access arrangements to protect the telephone network from high voltages or signals of too great an amplitude. Similarly, acoustical arrangements may be designed, where necessary, to change the signals so that they do not interfere with other signals being transmitted through the network.

Additional circuitry to protect the network from signals which do not conform to the requirements of the network is often referred to as "interface equipment" and the standards related to this equipment are called "interface standards". Protection arrangements may be part of the internal circuitry of equipment to be connected to the facilities of networks, or may be separate. Separate arrangements may be included as part of further equipment, such as those used for the conversion of signals in a digital format into the appropriate analogue format.

# CHAPTER III

# MANUFACTURE OF VOICE TERMINALS

## 1. Manufacture of Electronic Voice Terminals

The manufacture of voice terminal equipment is carried on very differently today than it was in the recent past. A major portion of the manufacturing operation involved metal fabrication processes which were often complicated and required a series of operations on the same part. Integration of different stages of the manufacturing operation increased the complexity of the facilities. The machinery required to perform these processes is extensive and entails large capital expenditures. Other processes, such as the coil winding required in the production of electromechanical telecommunication equipment, also involve the use of extensive machinery. Similarly, plastic mouldings for telephone sets and for component parts of PBXs and KTSs are manufactured with the use of costly equipment.

The change to electronic technology and the continuing advance of electronic techniques are two distinguishing features of the industry. The application of electronic technology has changed the production processes used to manufacture telecommunication equipment. The direct effect is on the circuitry within all types of terminal equipment. In addition, the size and weight of PBXs and KTSs are dramatically less than comparable machinery incorporating antecedent technology. Connecting, supporting and enclosing structures, be they metal or plastic, have been reduced in scale.

The same is true of partially or all-electronic telephones for which the housing is much smaller than that required for the familiar electromechanical telephones.

The manufacturing of electronic equipment does not, on the whole, consist of production and assembly of parts.

It involves, rather, the purchase of components which are assembled and tested. Within the entire area of electronics in North America, few corporations manufacture many of their own electronic components. This is apparently one cause for the reduction in employment in telecommunication equipment manufacturing. Another is that the redesign of equipment made possible by ongoing advances in electronics circuitry permits overall cost reductions. Concomitantly, employment shifts from manufacturing to product development.

The steps entailed in bringing a PBX or KTS to market may be roughly broken down into:

a) product development (a large topic);
b) manufacture of printed circuit boards (PCBs);
c) obtaining electric and electronic components and assembly of the components on the circuit boards;
d) assembly and wiring of circuit boards in cabinets;
e) testing, an activity that occurs at a number of stages of sub-assembly as well as when the product is finished, in order to identify faults before they become difficult and costly to isolate and rectify.

One of the major consequences of a reliance on electronic technology is that it has led to much shorter product lives than was true with electromechanical technology. Feature-enhancing and cost-reducing changes may now be designed into equipment without the need for retooling or other major changes in plant and equipment. The product life of electronic PBXs and other electronic telecommunication equipment is said to be five to seven years. The investment entailed occurs at the design and development stage, which includes the development of testing procedures for new circuits. Typical levels of expenditure on design and development among telecommunication firms are of the order of eight to ten per cent of sales, which appears to be an approximate target that will be more or less missed depending on the availability of necessary personnel and on how well management predicts sales.

The indications are that volume manufacturing of PCBs is a highly capital-intensive operation that requires far more investment and know-how than is required for PCB assembly at the level of automation achieved in the assembly operations in Canada. There are a number of specialized PCB producers available to firms that do not wish to undertake manufacture on their own.

Most information is available on the purchase and assembly of components, in part because these are the easiest steps to understand. Another reason is that the evidence tended to focus on these steps because foreign firms that market in Canada and that wish to manufacture here are likely to undertake assembly and testing.

A major part of the assembly process involves insertion of electrical and electronic components into printed circuit boards, a process which can be automatic or manual. Typically, an assembly operation involves both automatic and manual processes, depending on the components, and the scale of operation. The soldering of inserted components, and trimming and cleaning processes are the remaining major steps in the assembly of circuitry. Conveyor belts or less automated means are used to move the evolving product from one stage to another or through a process. Production of the final product, such as a finished PBX, involves the joining of these circuit boards with connecting, supporting and enclosing structures.

Extensive testing occurs throughout the production process. Some of the manufacturers who appeared before the Commission indicated that they use testing equipment of their own design. The objective is to ship a product that will be trouble-free in its working environment. In general, the sooner trouble in any component, sub-assembly or complete product is identified, the less it will cost to rectify it. Testing is costly, however. Although the degree to which each firm tests varies with the design of its product and its testing equipment, all firms test their product extensively before it is shipped to the customer. In a product such as a telephone the testing is devised to ensure the product can withstand physical abuse.

A witness from Rolm estimated that its testing equipment cost four times as much or more than did its assembly equipment. Information received from Mitel indicates the two costs are much closer together. The significance of testing as a cost factor is reflected in the fact that it is a consideration in the design of the circuitry of products. The difference between the experience of Mitel and that of Rolm may be partially attributable to the product manufactured by each. Larger PBXs, produced by Rolm, involve more complex design and, consequently, more complex testing than do small PBXs.

## 2. Vertical Integration and Subcontracting

The size and maturity of an industry will generally determine the extent to which it contains specialist firms. Such firms offer a critical opportunity for smaller producers to participate in the industry. The availability of specialist firms is especially important to smaller producers in areas of production where a considerable investment in equipment or know-how is required for low-cost production. Alternatively, specialist firms permit producers of all sizes to expend capital and managerial talent where the firms have the greatest relative advantage. In an area such as "Silicon Valley" in California, there are numerous specialist firms which provide PCBs, board assembly, cabinets, and even certain kinds of testing. Aid in circuit design also is procurable under contract.

Although the number of specialist firms is more limited in Canada, it is possible to produce PBXs and KTSs with limited capital investment and with a high Canadian content. Design and product development, with rare exceptions, are done in-house. Northern, however, in pursuing the design of an electronic telephone, utilized the firm set up by a former employee in order to benefit from his know-how. Specialized firms exist in printed circuit board production, printed circuit board assembly, plastic moulding and metal work.

Thus, whereas the manufacture of equipment incorporating older technologies appears to have occurred largely within one facility, for the manufacture of electronic equipment several of the manufacturers in Canada make significant use of subcontractors. In fact, one small PBX manufacturer, Plessey, though engaged in product development, carries out only the final assembly and testing processes within its own facilities; it subcontracts metalworking, PCB assembly and other aspects of manufacturing to different companies specializing in these respective functions. Such subcontracting does not characterize the organization of the two large vertically integrated manufacturers in Canada.

Mr. C.G. Millar, Executive Vice-President, Operations, Northern Telecom, stated that as a general rule costs per unit fell as production moved up a "hierarchy of plant production arrangements". At the bottom of the hierarchy is an assembly plant with minimal capital investment. Subcontractors supply parts, or these are obtained from specialized plants within the firm. Mr. Millar emphasized the fact that Canadian subsidiaries of foreign firms draw on the latter's specialized plants also located outside Canada. Another level of plant described is a multi-product plant with sufficient volume to justify investment in equipment for parts production. The difficulties with this plant organization are those associated with frequent changeover or set-up of equipment. The cited advantages of such a plant over an assembly operation are in-house control over scheduling and the use of equipment more specialized to the operations entailed in production. Further cost savings are seen to occur when plants are specialized to an increasing degree.

Virtually nothing is known about the cost advantages of producing in-house over subcontracting. With regard to the risk of loss of production from causes such as fires and strikes, integrated firms do not appear to enjoy any advantage over those which purchase parts, components and subassemblies in arranging second and third sources. In the view of a witness from Gandalf, however, better control over quality could be maintained over circuit-board assembly if it were done in-house. The view was also expressed that the times when peak output was required within a particular firm were likely to coincide with increased output within the industry. Thus subcontracting was not viewed as an effective way of dealing with peaks in production.

## 3. Economies of Scale

Mr. Millar summarized Northern's conclusion on the economies of scale in the manufacture of voice terminal equipment as follows:

> "In the case of central office switching and pbx equipment production costs could be reduced by use of more dedicated facilities and by spreading R&D costs further if larger volumes of output could be achieved. . . .In station apparatus most additional economies of scale will be derived from spreading capital costs and utilizing more dedicated production equipment. To a lesser extent further economies of scale can be achieved by spreading R&D expenditures over greater output."

In addition, information on several areas of manufacture was provided by a number of other companies.

### a) Purchase of Electronic Components

Although there are a great many different types of electronic components used in telecommunication equipment and most of these are produced by companies specializing in the development and production of components, a limited number of components are produced within the telecommunication industry.* These tend to incorporate circuits designed within the industry for specific applications. The inclusion of this manufacturing capability within a manufacturer's facilities requires a larger production volume for efficient operation than do the assembly and testing operations.

In Canada, Microtel, Mitel and Northern produce thick film hybrids. Northern and Mitel also produce integrated circuits and Mitel makes a number of them that find application in other areas of the electronics industry. NTL at one time operated a subsidiary (MIL) that specialized in the production of electronic components for a broad market, but this company failed.

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* Western Electric, a giant company which produces a large volume of its own requirements, is an exception in the industry in North America.

Certain electrical components such as resistors and capacitors were said by Mr. H.R. Herron, President and Chief Executive Officer, GTE Automatic Electric (Canada) Ltd., to have been more readily available from Canadian sources at one time. The decline in this source of components was associated with the decrease in the manufacture in Canada of television and radio sets. As a consequence, many components are now imported into Canada.

The price paid for components decreases as the volume purchased increases. The amount of the discount varies from component to component and is contingent on several factors. The size of the supplier's inventory and the manufacturer's investment in the design of the component are two factors cited. Volume discounts are potentially of some significance since the cost of materials is the greater part of manufacturing costs. In Rolm's experience, the cost of assembly and testing the product accounts for only 20 to 30 per cent of manufacturing costs which represent about 60 per cent of the value of the product. In the communication equipment industry in Canada, which includes the telecommunications industry and is about twice as big, the cost of materials amounts to approximately 40 per cent of the value of shipments. This is consistent with Rolm's experience and is close to that of Mitel's, whose cost of materials in final form was stated to be 30 to 40 per cent of the selling price of equipment. Only a part of the materials purchased consists of electric and electronic components, however.

The purchase of small quantities as needed from existing inventories held by distributors makes components very expensive, perhaps two or three times more expensive than pre-ordering them in volume. Although there is general agreement in the evidence that the discounts to be obtained fall off fairly rapidly, it is difficult to pin down the magnitude of the savings to be enjoyed by firms of different size. Companies or divisions that are part of larger units such as Northern, Automatic Electric and ITT Canada have the advantage of being able to buy many components for terminal equipment which are also used in the manufacturing of other products. Thus the importance of volume purchasing applies mainly to firms such as Mitel and Rolm, manufacturing firms which produce a narrow product line and whose level of output is well below that of firms with broader product lines. Neither company appears to feel itself at an important disadvantage. This is partly because the level of savings from additional volumes would not result in much larger discounts. (Figures of five to 10 per cent were used, but it is not clear that these relate to their own situations.) Dr. M.C.J. Cowpland, from Mitel, mentioned two other factors: one is the appreciable mark-up enjoyed on a high-technology product such as electronic PBXs; the other is the critical importance of design which can, if well done, greatly reduce the number of components needed, as well as the associated manufacturing cost.

### b) Printed Circuit Boards

Prices of printed circuit boards and PCB assembly are also related to scale. Set-up costs are incurred in both cases whether firms produce in-house or purchase their requirements.

Only the larger of the companies manufacturing in Canada, NTL and Microtel, also manufacture PCBs. Although it was stated that a large volume of production is required, no quantitative information is available. Because the dimensions of PCBs can vary with different products, even the larger manufacturers purchase low-volume boards from other companies which specialize in their production.

### c) PCB Assembly

PCBs can be assembled manually. This is done only when output levels are too low to justify machine methods. As the volume of production of a particular type of PCB increases, the use of available machinery which will automatically insert ("stuff") components into the boards becomes justified.

Special equipment is used for the insertion of components because of differences in their shape. Furthermore, because not all components can be automatically inserted, automatic assembly processes frequently include a step in which a limited number of components are inserted manually.

The equipment for component insertion can be used to assemble circuitry for a variety of products. Although some companies make use of this equipment only for PBXs, other companies use the same assembly equipment to manufacture both central office switching equipment or transmission equipment also. Computer Assembly Systems, Limited (CompAS), at the time of hearings the only company in Canada specializing in the assembly of PCBs, assembles circuitry not only for telecommunication companies but also for companies in other sectors such as consumer goods.* Adaptation of the equipment for different products is achieved by changing the programs controlling this equipment.

The capital cost of equipment used in assembling at the scale of CompAS's operation and that of Northern in its PBX manufacture is modest - $500,000 to $1,000,000. Both operations involve the duplication of some automatic insertion equipment.

It was estimated that the cost per board fell by from 30 to 40 per cent as the volume produced moved from small, manual level to 1,000 boards in a run. Mr. H.R. Herron felt that the major advantage of automatic assembly is that errors that are costly to rectify are reduced. Mr. D.I. Snell, Vice-President of CompAS, stated that most economies related to machine set-up costs would be exhausted by runs of

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* There are some 65 companies in Canada producing PCBs. Their output ranges from approximately 20,000 boards/year to more than 1,000,000. A total of between 30 million and 40 million PCBs are assembled annually in Canada. The total includes products for computers, home entertainment, automobiles and other areas.

1,000 boards. To place this figure in perspective, Plessey predicted sales of 250 of its K-1 systems in 1979. At an average of 50 lines per system, this would represent something of the order of 7,000 boards per year. At an output of almost 150,000 boards per year in 1978, 7,000 boards would represent about two weeks' output for CompAS. But a factor such as the costs of holding inventory would determine how Plessey, which subcontracts its PCB assembly to CompAS, would schedule its orders. Whether the costs resulted from holding inventories or from smaller runs, Plessey would have to incur some cost penalty in the area of board assembly. Plessey's predicted output, virtually all of it for export, was only about five per cent of estimated PBX sales of systems of all sizes in 1979. Its output would represent a much larger percentage of sales below 100 lines, the capacity of the K-1.

### d) Testing

The production of components is characterized by yield - the percentage of components which initially operates as designed. Though many if not all faulty components are screened out before they are placed on PCBs, there is a further failure rate which occurs during functional testing. These failures can be associated with a number of sources including faulty soldering and component malfunction. Some of these failures may occur only after the equipment has operated for a period of time. For this reason, telecommunication equipment testing includes a "burn-in" process, in which the equipment is operated at elevated temperatures for a number of hours or days in an attempt to force any failures which would otherwise occur after the equipment is sold. The evidence is that most failures in the field occur early, i.e., within the first six months.

According to Mr. Herron, automatic test equipment can be justified for an output of 20,000 lines per year. This is a low production level in the industry, at least among the companies from which testimony was received. Plessey's evidence in the testing area is consistent with this figure. At its predicted 1980 output of 25,000 lines (at 50 lines per system), its testing equipment would be fully utilized. The capacity of testing equipment is limited and several of the companies appearing during hearings, especially those with larger volumes of production, are either using their equipment at capacity or have duplicated it.

### e) Depth of Employees' Expertise

Mr. Herron expressed the view that a certain, but unspecified, minimum production volume was required to enable a manufacturer to employ the number of employees sufficient to provide the range and depth of knowledge required in manufacturing. For example, he felt that the minimum level of output at which ITT Canada might commence production of electronic central office switches was too low to permit a desirable depth of knowledge.

### f) Product Development

Northern has stressed the importance of spreading R&D costs as a source of economies of scale. It is undoubtedly the case that product development costs per unit fall as sales increase. This is one aspect of economies of scale. A second concerns the question whether development efforts are more successful per dollar of expenditure in larger or smaller firms. *A priori* arguments can be made for both sides. What is clear in PBX and key system development is that successful new products have been and can be designed with relatively low capital expenditures.

### g) Economies of Scale and Size of Market

At least one-quarter million PBX lines were sold in Canada in 1979. This figure is derived from the estimate of annual dollar sales of $70 million and an average price of $300/line, which is probably on the high side. ITT stated that it could justify the utilization of automatic insertion equipment and assemble and test PBXs if it could achieve annual sales of 5,000 lines. ITT's figure is the lowest received for a company which undertakes assembly and testing. The low figure may possibly be attributed to ITT's existing manufacturing facilities for electronic products, which could allow the spreading of capital costs, thereby lowering the minimum required production level for PBXs. Siemens stated that it would require sales amounting to the equivalent of

20,000 lines before it would assemble PBX products in Canada. On the basis of an average line size of 100 (the SD-192 goes up to 200 lines), sales of 200 PBXs would be required. Rolm stated that it exhausted all economies of scale in the production of PBXs at 50,000 lines spread over several sizes. (The indications are that this is the very minimum scale required for assembly and testing of central office switches, which will be discussed in Part II of this Report.) If one takes the range of 20,000 to 50,000 lines and allows for the existence of several size divisions, it would appear that firms manufacturing in Canada require a fairly high percentage of the domestic market or appreciable export sales to obtain most or all economies of scale in purchasing and assembly.

### h) Telephone Manufacture

The traditional electromechanical telephone set consists of a very large number of parts which are assembled into sub-assemblies (e.g., transmitter, receiver, dial) and then into the final product. Producers are highly integrated. Plastic moulding, die-casting, plating and the use of heavy presses in the production of parts involve capital-intensive operations. For push-button telephones, printed circuit boards are required. In addition, the large number of operations in assembly requires considerable division of labour for efficient operation. The substitution of electronic components which replace a number of parts is gradually changing manufacturing from familiar ways.

Northern is the only manufacturer with an integrated operation within Canada. Parts manufacture and assembly operations are concentrated in its London, Ontario plant whose equipment is said to have a depreciated value of $32 million and a replacement value of $85 million. Employees number 1590. There are three shifts in the more capital-intensive parts of the plant. ITT's Winnipeg plant for telephone manufacture is in sharp contrast with Northern's London plant. It is devoted exclusively to the assembly of a limited number of sub-assemblies and types of set. Annual volume is of the order of 175,000 sets, which is well below a tenth of Northern's more varied output. ITT relies for most parts on a U.S. ITT facility specialized to produce telephone sets. It also subcontracts work such as plastic moulding and a limited amount of die-casting of metal parts to Canadian manufacturers.

Automatic Electric's operation lies somewhere between those of ITT and Northern. Employment is 325. Some of the difference in employment between it and ITT is translated into greater output, but part of the difference is absorbed in a higher degree of in-plant vertical integration. Automatic carries on plastic moulding in-house and performs more sub-assembly operations than does ITT. It obtains PCBs for push-button telephones from its sister plant in Brockville, but it relies very heavily on GTE's telephone manufacturing plant in the U.S. for parts.

# CHAPTER IV

# THE PURCHASE AND SUPPLY OF TERMINAL EQUIPMENT

## 1. Volume of Purchases

Various lines of equipment can be connected to facilities comprising telecommunication networks. Terminals used in non-voice communications include teletypewriters used in Telex and TWX networks, numerous terminals of varying levels of "intelligence" used in data communications, and terminals used in the transmission, receipt and reproduction of text and other recorded hard copy. With few exceptions, however, the evidence presented in this inquiry dealt with the category of equipment used in voice communications, that is, PBXs, KTSs and telephones.

Total equipment purchases (which do not include expenditures on land, buildings or vehicles) by the principal telecommunication carriers, which constituted the 19 corporate members of the Canadian Telecommunications Carriers Association, in 1977 amounted to $1,721.2 million. This figure is perhaps best modified before a comparison with expenditures on terminal equipment is made. Twenty-five per cent of the purchases represent capitalized labour, much of which was used to wire and install terminal equipment. In addition, there are two sizeable items, "pole lines" and "underground conduit", which do not represent electronic or electrical equipment. With the capitalized labour and estimated material purchases portion of the foregoing items removed, equipment purchases were $1,201.3 million. Purchases of terminals in 1977 are shown in the following table.

## TABLE 3

## EXPENDITURES ON TELECOMMUNICATION TERMINALS, 1977

| | ($ millions) |
|---|---|
| Telephones, packaged PBX, key telephone switching equipment, miscellaneous | 129.5 |
| Large (engineered) PBX | 59.0 |
| Teletypewriters (including cathode ray display units) | 15.5 |
| Data equipment (including modems) | 19.1 |
| Radio telephones and pagers | 20.2 |
| Total | 243.3 |

SOURCE: *The Principal Canadian Telecommunications Carriers: Expenditures on Telecommunications Equipment 1973-1982* (Department of Communications), Table 1, pp. 1-5 and written clarification received on the treatment of PBXs.

Investment in terminal equipment represents approximately 20 per cent of the $1,201.3 million spent on the class of equipment purchases discussed above. Also, the cost of wiring premises, of installing terminals and of connecting them to the networks constitutes an additional expenditure of $226.4 million, much of which is the capitalized labour included in the $1,721 million figure. Apart from the sale of wire, this item, "station connections", does not affect the manufacturing level, although it obviously represents a significant portion of the sales volume of a telco (or interconnect company).

No figures are available on purchases of radio telephones, pagers or data terminals by firms other than the principal Canadian telecommunication carriers. Important expenditures not covered in radio telephones and pagers are purchases by non-telco radio common carriers. In data equipment and cathode ray display units customers are, with minor exceptions, permitted by telcos and CNCP to obtain equipment from non-telco sources. In written information supplied to the Commission, B.C. Tel stated that modems used on Dataroute were supplied as part of the service and point of sale terminals (Vutran, manufactured by Northern Telecom) could be obtained from B.C. Tel only. In similar written information, Bell stated that it did not impose this requirement. All carriers supply teletypewriters used on the message-switched networks, TWX and Telex and charge for them as part of combined (bundled) rates. More than half the teletypewriters, however, are connected to private lines.

Written information provided by Bell and B.C. Tel strongly indicates that the figures used in Table 4 should be taken as a rough guide only to the size of the market for the various kinds of terminal. In addition to the fact referred to above, that purchases by carriers form only a part of expenditures on radio telephone and non-voice terminals, it also appears that a large part of the figures shown include expenditures in addition to payments made to equipment suppliers. The purchase of voice terminals in 1977 reported by Bell to the Commission is far less than the corresponding figure for Quebec and Ontario shown in the study from which Table 5 is taken. A small part of the difference is explained in the evidence of Mr. B.H. Tavner, General Manager, Network Services (Ontario Provincial), Bell Canada, who said that Table 4 includes the costs of installation in the case of large or engineered PBXs along with the cost of equipment, although such costs are shown separately as station connections in the case of other terminals. The source of the large remaining difference is, however, unknown.

Unfortunately, the first category of terminal in Table 4 is rather broad. In effect, terminals are divided into two categories: the first consists of those whose installation requires engineering, which is the case with large PBXs, the second, of all other terminals which can be installed and interconnected fairly easily, includes those PBXs in smaller sizes that are referred to as "packaged". It appears that there is not a uniform view among carriers as to whether a particular type of PBX belongs in one category or the other. In his evidence, Mr. Tavner refers to the SG-1 or Pulse as constituting a large PBX whereas B.C. Tel placed this equipment with packaged systems in the written information it supplied to the Commission. Bell did not provide such a breakdown in the information that it submitted, but, on the basis of Mr. Tavner's evidence, one concluded that Bell includes only some small obsolete systems in "packaged" PBXs.

The taxonomy used by B.C. Tel has been used in preparing information supplied by Bell and B.C. Tel and in preparing Table 4. Nevertheless, there is no clear division between packaged and engineered PBXs which corresponds to small and large PBXs with regard to line size. A very recent vintage of PBX, Mitel's SX-200, with a capacity of 160 lines, is treated as a packaged PBX, as are Northern's SG-1 and SG-1A, with line capacities of 80 and 120.* There is no reason, however, to believe that most PBXs are at, or close to, their maximum line capacities and it is reasonable to use 100 lines as providing a rough division between packaged and engineered systems.** More than 85 per cent of Bell's installed PBXs and 93 per cent of B.C. Tel's had fewer than 100 lines, in 1979. A very different situation exists, however, for expenditures on packaged and engineered PBXs since a large system can have as many lines as the combined number of lines of several small systems. In 1977, almost 52 per cent of the combined expenditures on PBXs by Bell and B.C. Tel were for engineered systems. Through the years 1977-80,* engineered PBXs accounted for 60 per cent of expenditures; Bell increased its purchases of engineered PBXs during the period relative to packaged PBXs and the reverse occurred in B.C. Tel's purchases. Mr. J.D.M. Davies, Vice-President of Business Development, Northern Telecom, estimated that annual Canadian PBX sales of all types in 1979 were about $70 million. The combined sales of Bell and B.C. Tel suggest that this is a reasonable estimate, particularly if the SL-1 special telephone sets are taken to be included in the estimate.

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* Siemens' SD-192, purchased by Bell but not by B.C. Tel, with a line capacity of about 200, has been treated as a large or engineered system. It is, however, competitive with the SX-200 and might have been included with the packaged systems.

** This dividing line was suggested by DOC in responding to a query about the published results of their survey.

Table 4 shows the combined purchases of Bell and B.C. Tel for the principal categories of voice terminal. One of the striking facts is the relative size of expenditures for single-line sets used in households and small businesses. The effect of import competition on domestic manufacturing is usually stressed in relation to PBXs and key systems because these types of equipment are expected to attract the most intensive activity by interconnect firms. Thus, it is clear that a large volume of sales is at stake in ordinary telephones and in telephones used in conjunction with PBXs and key systems, that, in many systems, can be purchased from manufacturers other than from those which supply the control equipment.

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* Bell figures for 1980 cover only the first nine months.

### TABLE 4

### COMBINED PURCHASES OF VOICE TERMINALS OF BELL AND B.C. TEL, 1977-80*

| | ($ thousands) | (per cent) |
|---|---|---|
| Telephones | | |
| Business sets | 48,766 | 13.5 |
| Single line sets | 111,836 | 31.0 |
| Coin sets | 12,821 | 3.6 |
| PBXs | | |
| Large (engineered) | 79,979 | 22.2 |
| Small (packaged) | 51,198 | 14.2 |
| Key Systems | 56,209 | 15.5 |

SOURCE: Written information to the Commission.

* Bell figures for 1980 cover only the first nine months.

The regional distribution of terminal equipment purchases departs considerably from the regional distribution of all equipment purchases. This is illustrated in the following table. Apart from the broad "Telephones" category, the purchases of terminal equipment by the Atlantic telcos ran well below their relative share of all equipment purchases. The telcos in Western Canada purchased a much higher percentage of radio telephones (and possibly pagers) than might be expected from their purchase of all equipment. This undoubtedly reflects the much greater use of radio telephones in Alberta than in other parts of the country. Another factor about which less is known is the magnitude of purchases by non-telco radio common carriers in different parts of the country. In areas where they are particularly strong, this will be reflected in relatively low purchases by the telcos. The western telcos' purchases of large PBXs and "teletypewriters" in particular were well below their share of overall purchases. The purchase of "teletypewriters" is concentrated in Quebec and Ontario, with the total swelled by the purchases of CNCP. The percentage share of all equipment purchases is also exceeded in Quebec and Ontario by data terminals and large PBXs. The purchases of CNCP were important in data terminals, but Bell accounted for almost all of the expenditures on large PBXs, which are defined by Bell to include almost all of its PBX purchases.

TABLE 5

REGIONAL PERCENTAGES OF TERMINAL EQUIPMENT PURCHASES, BASED ON THE SUM OF 1975-77 PURCHASES

| | Atlantic Provinces | Quebec-Ontario | Western Canada |
|---|---|---|---|
| All equipment | 7.97 | 54.48 | 37.55 |
| Teletypewriters | 2.28 | 80.49 | 17.23 |
| Telephones | 6.88 | 56.75 | 36.36 |
| Radio telephones | 4.51 | 38.13 | 57.36 |
| Data | 2.80 | 62.48 | 34.72 |
| Large (engineered) PBXs | 4.51 | 67.26 | 28.24 |

SOURCE: *The Principal Canadian Telecommunications Carriers: Expenditures on Telecommunications Equipment 1973-1982* (Department of Communications), Tables 1-4.

## 2. Suppliers

The technological advances that have altered the nature of telecommunication equipment and changed the manufacturing processes have also attracted a larger number of suppliers. In the past, only a few very large corporations were involved in the manufacture of a relatively full range of telecommunication equipment. In Canada, Northern Telecom and AEL Microtel (formerly GTE Automatic and GTE Lenkurt) faced mainly subsidiaries of international giants such as ITT, Ericsson and Siemens. The gaps in product lines afforded niches for smaller, specialized manufacturers; such was the point of departure of Mitel Corporation. As yet, the relatively small companies and the new entrants supply a limited range of products, mainly in the area of terminal equipment.

Within the terminal equipment category, there are a large number of potential suppliers of voice terminal equipment to the Canadian market. These include the large manufacturers of a full range of telecommunication equipment in Europe, Japan and the United States, as well as a number of suppliers whose existence has been made possible by interconnection in the United States and the easier crossing of industry boundaries resulting from the move away from electromechanical to electronic equipment. The suppliers participating in the U.S. market provide a useful indication of the potential suppliers to Canadian buyers of terminal equipment. A survey of manufacturers and importers by the United States International Trade Commission* found that among

> ". . . the 38 firms in 1977 which manufactured or assembled equipment in the United States, 22 firms produced telephone instruments; 23 produced branch exchange equipment, . . . and 17 firms indicated

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* *A Baseline Study of the Telephone Terminal and Switching Equipment Industry.* Report to the Subcommittee on Trade of the Committee on Ways and Means of the U.S. House of Representatives on Investigation No. 332-92 Under Section 332 of the Tariff Act of 1930, as Amended.

> production of other types of equipment, principally subassemblies and key system switching equipment."

The product line of 14 firms which imported only is not stated.

Mr. J.D.M. Davies, of Northern Telecom, was asked about the firms against which Northern was in competition in the U.S. in selling its SL-1 and SG-1 PBXs in 1979. The largest supplier in the U.S. is, of course, Western Electric, which sells through AT&T's operating companies. According to Mr. Davies, the U.S. firms which it meets in competition in selling its SL-1, a large-size digital switch with a capacity range of 100-5,000 lines, are Digital Telephone Systems, Inc., a subsidiary of Farinon (which in turn was recently acquired by Rockwell International), Rolm, GTE and Stromberg-Carlson. Rolm is one of Northern's strongest competitors in the interconnect market in the U.S. The foreign firms are Nippon Electric, Hitachi, Fujitsu of Japan, and CIT Alcatel and Dumont-Schneider of France.

The products of these companies are probably not all competitive in every application. For instance, it is doubtful whether the bottom size range of the SL-1 is cost effective against switches designed for the small PBX market, which might be taken to go up to 160-200 lines, the upper capacity range of the switches recently purchased by Bell from Siemens and Mitel. As well as certain machines being more cost effective in certain size ranges, their feature packages might make them more attractive than competing products in particular applications such as in airlines, hotels/motels and hospitals.

The SG-1 is an electronic analogue machine introduced in 1972 and, although it has been a very successful product, it is at the end of its product cycle. It comes in two versions, with 80-line and 120-(SG-1A) capacity limits. Referring to suppliers of competing equipment, Mr. Davies listed Mitel, Siemens, LM Ericsson, Nippon, Digital, GTE, ITT, Oki, Fujitsu, and added, "just about everybody in the game has a small switch." Once again, the products which are most directly competitive will vary with size range and application. In this regard it is instructive that Mitel is producing three switches in the "small" category.

There are, as shown by the International Trade Commission's survey, a large number of suppliers of telephone instruments, those which perform solely their long-standing functions and those which incorporate speed dialing, automatic dialing and other functions which require memory and calculating capacities. There are only five full-scale manufacturers of telephone instruments in North America: Western Electric, Northern Telecom, ITT, GTE and Stromberg-Carlson.

A number of terminal equipment suppliers gave evidence during the course of the inquiry. With very few exceptions, they had some kind of direct presence in Canada. Their activities in Canada ranged from sales and servicing, through assembly of imported components along with subcontracting to Canadian firms, to product development and manufacture. One of the major differences between more recently established Canadian-based firms, such as Mitel Corporation and Gandalf Data Communications Ltd. on one hand, and an established firm, such as Northern Telecom on the other, is the extent to which firms produce their own parts or components, a feature referred to by Northern as the "depth of manufacture", that is, vertical integration in manufacturing. The newer firms tend to subcontract parts and some component manufacture to other Canadian firms, while Northern tends to produce its own.

A major difference between Canadian and foreign-based firms lies in the extent to which product development is carried on in Canada. While there are significant differences among firms, the degree of overall product development activity in Canada tends to be much higher in the case of Canadian-based firms. Individual product development may be different: for example, Northern has concentrated development activity of its PBX line of products in the U.S., but development activities in the case of central office switching and transmission are located in Canada. ITT has given major development responsibility of a key system to its Canadian subsidiary, but it does not participate in major product development. The location of product development, as is generally known, is dependent to some degree on existing and potential market penetration, but such dependence is more marked in the case of manufacturing. The importance of home base to the location of product development should not, however, be overlooked. For several years Mitel was almost totally dependent on exports in the sale of its PBXs, while its principal development activities were centered in Canada. Similarly, Northern has by no means totally followed the market in the location of its development activities, although development activities in the U.S. have grown along with sales in that country.

The table below shows the market shares of a number of suppliers of station apparatus or terminal equipment to major Canadian telephone companies in 1975:

### TABLE 6

### MARKET SHARES - 1975

| | Percentage |
|---|---|
| Northern | 51.4 |
| Automatic | 8.2 |
| A.E.I. | 3.0 |
| ITT | 3.2 |
| CGE | 1.1 |
| Canadian Motorola | 2.2 |
| Ericsson | 1.2 |
| International Systcoms | 1.0 |
| Marsland Engineering | 1.7 |
| Wescom | 0.8 |
| Others | 26.2 |

SOURCE: Returns of Information from telephone companies, 1977.

Northern, it is clear, held and still has by far the largest share of the total sales of terminal equipment of all types, but the broad grouping tends to result in an understatement of the market shares of all suppliers in the equipment categories in which they provide a line of products. Telephone sets, key systems, and PBXs, in which Northern's sales are concentrated, accounted for 74 per cent of terminal equipment purchases in 1975. Thus, Northern's share of hard-wired voice terminal sales was 69 per cent. Automatic Electric made roughly 11 per cent of such sales. A similar degree of concentration is found within other narrow equipment categories, with Canadian Motorola and International Systcoms having been the principal suppliers of mobile radio terminals, and Marsland Engineering and Teletypewriter Corporation, a U.S. subsidiary of Western Electric, having accounted for the bulk of teletypewriter sales. While market shares provide a potentially useful snapshot of the relative positions of firms in an industry, the latter two firms serve as a good example of the need to use such figures only in the context of other industry information. The Teletypewriter Corporation is, by virtue of its relationship to AT&T, an important corporation within its field. It generates its own technology and operates very large facilities. Marsland, on the other hand, relied on Teletypewriter technology, some of it acquired under licence and some of it obtained as the result of observing design changes of equipment as it appeared on the market.

Another important point to note about share-of-sales figures is that they represent achievement over a number of years. For instance, LM Ericsson successfully marketed crossbar PBX some years ago. They met an equipment need that could not be filled by either Northern's or Automatic's PBXs. Telcos made purchases for replacement parts and expansion of the Ericcson products long after the telcos had begun to install newer equipment.

The suppliers who appeared during the inquiry account for all but a small fraction of sales of voice terminals. As in other areas of telecommunication equipment, Northern is by far the largest supplier, followed by Automatic and a number of suppliers in specific product areas. Imports have not been an important source of supply except where gaps developed in the Northern and Automatic product lines. The Hitachi crossbar PBX was distributed by Automatic for a number of years and LM Ericsson's large crossbar switch enjoyed good sales as well. The number of potential suppliers, however, far exceeds the number of those who had success in Canada or those who appeared in the inquiry. The company descriptions are restricted to the latter group. The importance and identity of potential suppliers are discussed elsewhere in the report.

The coverage of existing suppliers of non-voice terminal equipment (or data terminal equipment in a broad sense), from the evidence given by those suppliers who appeared at the inquiry, is limited. In written information supplied by Bell, B.C. Tel and CNCP, 40 suppliers of data terminals are identified, although the number supplying state-of-the-art equipment currently being purchased is smaller. Northern and Automatic supplied only one or two products of the many non-voice terminals. The company descriptions given below cover only a fraction of all suppliers, the majority of which are U.S. firms.

Customers' ability to obtain most types of data terminal equipment from non-carrier sources is not in question.

### (1) Northern Telecom Limited

Northern Telecom Limited (NTL), called Northern Electric Company, Limited upon incorporation in 1914, has been active in Canada since 1892. Initially, the company was majority-owned (56 per cent) by Bell Canada and minority-owned (44 per cent) by Western Electric, a manufacturing subsidiary of AT&T in the U.S. The latter has in the past owned shares of Bell Canada, but in 1975 the last of these were sold. Western Electric's ownership share of NTL was acquired by Bell Canada in 1962.

Since 1973, Bell Canada's ownership share in NTL has been reduced by the sale and issue of shares. Bell remains the majority shareholder, but the percentage has declined from 100 per cent to 55 per cent. The equipment sold and manufactured by NTL covers the full range of telecommunication products. A significant part of this equipment is accounted for by products either developed by NTL or obtained under an agreement with Western Electric, but acquisitions have resulted in important extensions to NTL's product line. These acquisitions include Cook Electric, Northeast Electronics, Sycor, Inc., Data 100 Corporation, Danray, Inc., Spectron Corp. and Intersil, Inc. The acquisition of Data 100 and Sycor in 1978 substantially added to NTL's line of data or computer-related equipment. In comparison, the Danray products more closely complemented NTL's existing line. During the same period, NTL itself developed new products such as digital switching and transmission equipment.

In 1969, Bell-Northern Research Ltd. (BNR) was established; majority ownership shifted from Bell Canada to NTL in 1976. Microsystems International Limited (MIL) was formed in 1969 as a wholly owned subsidiary of NTL to undertake the research, development and production of electronic components, but was dissolved in 1974. Nedco Ltd. was set up in 1972 as a wholly owned subsidiary to distribute equipment across Canada, and was sold in 1979.

In 1979, NTL operated 55 manufacturing plants (26 in Canada) and employed 33,301 people, approximately 18,500 in Canada, 12,700 in the U.S. and the balance outside North America. Its holdings in the U.S. are operated through Northern Telecom Inc.; those outside North America are operated through Northern Telecom International Limited.

NTL has established facilities in the U.S. similar in scope to those found in Canada. Although Bell Canada remains NTL's single most important purchaser, markets outside Canada, particularly in the U.S., have become increasingly important in terms of overall sales.

Sales in Canada accounted for approximately 83 per cent of total sales in 1977. These declined to approximately 67 per cent in 1978 and approximately 53 per cent in 1979. During the same period, U.S. sales increased from 16 per cent of total sales (1977) to 30 per cent (1978) to 39 per cent (1979). Total sales have almost doubled from 1975-79. User equipment as a percentage of total sales has climbed from 17 per cent in 1975 to 46 per cent in 1979. User equipment sales for 1978 and 1979 include electronic office systems as a result of NTL's U.S. acquisitions.

TABLE 7

NTL SALES (1975-79)

| Year | Total Sales ($ millions) | User Equipment Sales ($ millions) |
|---|---|---|
| 1975 | 996.8 | 171.3 |
| 1976 | 1,083.5 | 213.8 |
| 1977 | 1,221.9 | 275.3 |
| 1978 | 1,504.6 | 545.8 |
| 1979 | 1,900.5 | 874.5 |

SOURCE: *Northern Telecom Limited Annual Report, 1979.*

### (a) Telephone Sets and Associated Products and Services

NTL's telephone sets include the ordinary telephone set, in wall or desk versions, and equipped with rotary or push-button dialing. NTL also distributes premium or decorator sets. NTL produces a coin telephone, an electronic telephone and the telephone set designed to operate in conjunction with NTL PBXs or KTSs.

Ancillary equipment manufactured and distributed by NTL includes residential and business speakerphones, automatic dialers, telephone answering devices, equipment used for the purpose of conference telephone calls, headsets and a variety of plugs, jacks, cords and adaptors.

Finally, NTL provides repair and overhaul services for telephone sets, ancillary telephone set equipment and non-telephone set terminals.

### (b) Key Telephone Systems

Included in NTL's range of KTSs are the NE-1A2, the SM-1 and the Vantage 12. The NE-1A2, introduced in 1968, is of modular design and can be used with only a single external line. The features available with this equipment include call hold, lamp indications, conference, manual and dial intercom, off-premises extensions, Digitone dialing . . .

The SM-1 is a more recent NTL product. NTL characterizes this product as combining KTS features, such as are available with the NE-1A2, with features traditionally associated with PBX systems. The SM-1 can be used with, or without, a specially designed telephone set. The range of the SM-1 extends from six main telephone sets and three external lines to installations with up to 55 main telephone sets and 18 external lines.

The Vantage 12 is a more recently announced KTS. It is an electronic kit for use in installations having up to 12 main telephone sets and six external lines. Various features are provided to the user by electronic modules inserted into the housing of the telephone set. This equipment includes SPC common control equipment which can be programmed to provide different features. The system is manufactured with all features. Selective removal of features occurs when preparing the product for a specific user.

### (c) PBX Equipment and Related Switching Equipment

Two of NTL's PBX systems are intended to be used as terminals of voice telecommunication networks. One of these, the Pulse system, originates within NTL. The other, the Danray CBX product line, was acquired.

The Pulse equipment is an electronic PBX incorporating a time-division switching technique and electronic switches. It is an analogue PBX, first offered for sale by NTL in 1972. The Pulse 80 (or SG-1) can be connected to a maximum of 80 internal lines (i.e., main telephone sets), and the Pulse 120 (or SG-1A) to a maximum of 120 internal lines. Each can be connected to a maximum of 30 external trunks. A hotel/motel version of the Pulse system became available in 1976.

The Danray CBX (Computerized Branch Exchange) system is substantially larger than the Pulse system and can be connected to from 400 to 4000 internal lines in one version, or from 3000 to 8000 internal lines in another. The latter is referred to as a CMX (Computerized Master Exchange). These CBX systems were first offered for sale in 1974 and incorporate a space-division switching technique and electronic switches. This equipment carries analogue signals at a rate of 9600 bps. These systems can be used for data as well as voice communications.

NTL's SL-1 equipment can provide, in addition to PBX features, KTS, Centrex and other features. The system incorporates a time-division switching technique, using a digital signal format and operates under stored-program control. This digital PBX can be connected to from 100 to 5000 internal lines. The system is designed such that data can be transmitted in a digital format from a telephone set through the SL-1 switches and on to other terminal equipment. For the transmission of data over external analogue lines connected to the SL-1 (lines connected to a public switched network, for example), modems can be shared by data originating at diverse telephone sets connected to the SL-1.

Among the Danray products acquired by NTL is a Computerized Tandem Switching System (CTSS), switching equipment first offered for sale in 1974 and used to control or manage long distance communications. The CTSS 1000 can be connected to from 100 to 1000 external lines; the CTSS 4000 can be connected to up to 4000 external lines. These systems provide least-cost routing and printed reports on calls and trunk usage. The additional subsystems enhancing the features provided by the CBX systems are also available for CTSSs.

The SL-1, CBX and CTSS equipment include in their design a capacity to transmit data at a rate of 9600 bps. The latter two types of equipment can transmit at a higher bit rate if required.

SL-10 equipment can operate as controlling and switching equipment in a data network. Unlike the switching products discussed previously, SL-10 is designed for packet switching. The system can be used in a distributed data network where dispersed data terminals are connected, through the SL-10 system, to a computer, or where a multitude of computers and terminal equipment are connected together, by SL-10 equipment, to form a telecommunication network.

Development of a small PBX with a capacity of 200 lines, called an Office Communications System (OCS), was discussed during the hearings. To date, development efforts have not resulted in a product that satisfies Northern's goals for that segment of the PBX market.

### (d) Data Terminals

With the acquisition of Data 100 and Sycor, NTL's product line was extended in the area of data signal terminals and systems. Generally, the products are peripheral equipment such as keyboards, cathode ray terminals, printers and storage devices together with a central processor, i.e., equipment which interconnects and controls the peripherals. The central processor may be further connected to an end point of a telecommunication network.

### (e) Videotex

At Palo Alto, California, NTL/BNR is working on Intelgraph, a two-point interactive visual system primarily for use between two groups meeting in distant cities. Graphic information is transmitted and light pens are used to add to or subtract from the graphics. Although a third or fourth party may be added, the number of parties is quite limited. Intelgraph will work over the telephone network using special data modems. An additional connection will be required for voice.

Vista, the Canadian videotex system of Bell, is available to all users and is interactive between a user and a data base rather than between users. Vista uses an alphamosaic display which requires an extensive protocol. It can be compared to the Telidon system which uses alphageometric display economizing on the protocol information. Vista was originally developed by Bell Canada. In a 1980 joint undertaking with the Department of Communications, Bell tested the Telidon concept of sending data, using 1000 terminals.

### (f) Manufacturing Facilities

NTL has manufacturing facilities for terminal-related products in Canada, the U.S. and outside North America. The Canadian facilities are located as follows:

| | | |
|---|---|---|
| (1) | PBXs, KTSs | Belleville, Ontario<br>Calgary, Alberta (planned for 1982) |
| (2) | Telephone Sets and Components | London, Ontario<br>Amherst, Nova Scotia<br>Regina, Saskatchewan |
| (3) | Telephone Set Repair and Overhaul | Saint John, New Brunswick<br>Montreal, Quebec<br>North York, Ontario (Norelco)<br>Calgary, Alberta |
| (4) | Semi-Conductors (Custom LSI) | Ottawa, Ontario |
| (5) | Teletypewriter and Electronics Repair and Overhaul | North York, Ontario (Fenmar) |

The U.S. facilities include:

| | | |
|---|---|---|
| (1) | PBXs | Santa Clara, Cal. |
| (2) | Telephone Sets | Nashville, Tenn. |
| (3) | Telephone Set Repair and Overhaul | Kevil, Ky.<br>Leesburg, Fla.<br>Tampa, Fla.<br>Texarkana, Tex.<br>Sanford, N.C. |

| | | |
|---|---|---|
| (4) | Semi-Conductors | San Diego, Cal. (planned for 1981) |
| (5) | Tandem Switching for Private Networks | Richardson, Tex. |

In addition, printed circuit boards, circuit packs and hybrids are produced at Morrisville, N.C., and West Palm Beach, Fla. Furthermore, manufacturing facilities related to computer system (terminal) products are located at Ann Arbor, Mich., Goldsboro, N.C., St. Paul, Minn., Minnetonka, Minn., and Warwick, R.I.

Outside North America, NTL facilities are located as follows:

| | | |
|---|---|---|
| (1) | PBXs | Galway, Ireland |
| (2) | Telephone Sets and Components | Galway, Ireland<br>Penang, Malaysia |

Other terminal products plants are located in Ballincollig (Cork), Ireland, Hemel Hempstead, Great Britain, and Istanbul, Turkey. There is also a facility at Rio de Janeiro, Brazil.

### (g) Research and Development

Initially, both NTL and Bell Canada relied, under a service agreement, upon their respective counterparts in the AT&T corporate complex for technical expertise and information. With the U.S. Consent Decree of 1956, the access that Western Electric was willing to give Northern to its technology was changed. By the early 1960s, while receiving general information on Western Electric's equipment, NTL was required to purchase detailed technical and manufacturing information separately. According to testimony from Bell Canada witnesses, the cost of this information progressively increased and, by 1972, the flow of information from Western Electric to NTL had effectively ceased. The formal agreement between the two corporate groups was terminated in 1975.

Bell Canada has stated that independent capabilities were developed during the early 1950s and that an R&D division was formed at NTL in 1957. It was also stated that NTL initially developed expertise in the areas of cost reduction techniques, quality control and production processes. The first final product to originate with Bell/NTL proprietary designs was apparently a PBX in 1961. The Contempra telephone set was tested in London, Ontario in 1968, and introduced on the market in 1969. A significant number of products have been developed since then.

Dollarwise, the major share of Bell Canada's purchases of equipment, and of services such as maintenance, overhaul and repair, is from NTL. Also, Bell Canada is NTL's principal customer. Manufacturing and provision of telecommunication services are largely carried out independently by NTL and Bell Canada, respectively. It is clear from the evidence gathered by the Commission in the course of hearings, however, that NTL and Bell Canada participate jointly in originating new equipment for providing telecommunication services.

NTL and Bell Canada work together in research and development, equipment articulation, and the process which takes a product from its prototype version through to a form in which it is ready for commercial sale. The latter involves detailed testing of the equipment, any revision in design and detail found necessary and the formulation and preparation of installation, maintenance and repair procedures and documentation.

Both NTL and Bell Canada share ownership of Bell-Northern Research (BNR), the largest commercial research and development organization in Canada. In addition, NTL has R&D facilities within its own organization. Witnesses for Bell Canada stated that the vertical integration with NTL allows technical information to be exchanged freely throughout the corporate group. Although NTL can collaborate with companies (e.g., AGT) with which it is not linked by ownership, the information flow is said to be relatively constrained. For example, when corporations unrelated as to ownership engage in joint product development, the process has to be formalized in terms of a legal document, a contract. Some of the joint projects of NTL and Bell Canada are said to lack the precision required for such a contract. Alternatively viewed, documents prepared for use within NTL and Bell Canada would not be sufficient for the purposes of collaboration between independent companies. Bell stated, however, that this imprecision does not characterize projects on equipment such as PBXs or equipment designed to work with the existing facilities of the telecommunication network, but does characterize projects that are part of the evolution of the network. NTL's DMS central office switching equipment was cited as an example of equipment for which a precise document could not have been drawn. A second type of constraint on the exchange of information was said to follow from the fact that the "day-to-day" relation existing between NTL and Bell Canada would not characterize the efforts of two independent corporations.

The distinctions between R&D activities funded separately and internally by NTL and Bell Canada can be traced to their respective roles as equipment manufacturer/vendor and telecommunication service supplier (or equipment user). The division of activities in joint R&D programs reflects this, with equipment development being funded by NTL and not by Bell Canada. An exception to this is the provision of Bell Canada's financial support in instances where the sales volume of the equipment is expected to be insufficient for NTL to recover development costs, or where development risks are deemed, by some measure, to be too high.

Equipment development begins with the identification of equipment required. Specification of its performance requirements follows, and may be revised as the equipment is brought from a prototype through to a commercial product.

The claim was advanced that NTL originates some equipment concepts and could carry through by itself in the above process. Bell Canada, it was said, could join in the program at different points. After Bell Canada joined, but not before, there would usually be a commitment by the telephone company to purchase the final product. The Bell Canada witness could offer only one example of equipment for which the company did not become so committed.

## (2) AEL Microtel Limited

AEL's telephone equipment manufacturing operations began in Brockville prior to 1930 and were associated with wire and cable products. Acquired in 1930 by the Automatic Electric group of companies of Chicago, Illinois, the Brockville facilities were enlarged to include the manufacture of automatic and manual telephone switching systems and telephone instruments. The wire and cable manufacturing facilities were sold in 1953.

AEL Microtel was formed when B.C. Tel acquired GTE Automatic Electric (Canada) Ltd. and its wholly owned subsidiary, GTE Lenkurt Electric (Canada) Ltd., from the General Telephone & Electronics Corporation (GTE) of the U.S. Automatic manufactures switching/subscriber equipment and Lenkurt manufactures transmission equipment. Prior to their acquisition by B.C. Tel, which itself is controlled by the U.S. GTE, these firms reported to the U.S. parent through GTE International Incorporated. Their combined sales in 1978 were $151 million, or one tenth of those of Northern.

B.C. Tel acquired these firms, which were its major suppliers, in 1979. AEL Microtel owns a research subsidiary, Microtel Pacific Research Limited, which was established at about the same time that B.C. Tel acquired AEL. At the time of their appearance before the Commission, Automatic and Lenkurt were still direct subsidiaries of GTE of the U.S.

The U.S. parent company operates telephone networks and manufactures telecommunication equipment in that country. In addition to such equipment, GTE produces other electrical equipment, consumer electronics, lighting and precision materials.

### (a) Terminal Products

AEL Microtel manufactures and sells PBXs which operate under stored-program control (SPC) and incorporate digital switching techniques. The company's three related digital PBX systems are called the GTD-120, the GTD-1000 and the GTD-4600. The number refers to the maximum number of lines which can be connected to each system. There is also a version of the GTD-4600 which can be connected with up to 9200 lines (i.e., 4600 x 2).

The company distributes a small PBX other than the GTD-120. This PBX is called the GTD-60 and incorporates analogue switching techniques. It also distributes a Hitachi crossbar PBX. According to a recent DOC report, sales of this equipment dropped sharply after electronic equipment was introduced in 1976. AEL reportedly still distributes a variety of equipment (test equipment, automatic dialers, traffic measuring systems, etc.) for other manufacturers.

The company appears to sell a full range of telephone sets and KTSs, but a full description of the product line was not forthcoming during hearings. AEL manufactures telephone sets and KTSs based on Western Electric designs.* The company also sells an electronic telephone set, the Flip-Phone.

### (b) Manufacturing Facilities

AEL manufactures terminal equipment in Lethbridge, Alberta, and Brockville, Ontario. The Alberta facilities are dedicated to the assembly of telephone sets. Plastic moulding for the telephone sets was recently transferred from Brockville to Lethbridge.

Switching products, principally central office switching equipment, are also manufactured in Brockville. At the time of the company's appearance, it was also manufacturing, or preparing to manufacture, the GTD-120, the GTD-1000 and the GTD-4600 systems at this location.

The manufacture of KTSs was not discussed.

### (c) Research and Development

Sales were said to be insufficient to support the R&D activities which would be required to produce a broad product line in Canada. This is particularly true for switching products. The company has relied on R&D undertaken by GTE companies in the U.S. as the source of its new products. Although Automatic and Lenkurt witnesses testified prior to the formation of AEL Microtel and of the Microtel Pacific Research subsidiary, it would not appear that this arrangement will be much affected in the short run.

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* The other Canadian manufacturers of this equipment, including NTL and ITT Canada Limited, also manufacture products to Western Electric's designs.

In the area of switching and terminal equipment, an average of $2 million is expended annually on a laboratory employing 60 people. An additional $1.5 million is spent for engineering, an activity which employs 55 people who prepare the manufacture of new products. These funds are obtained primarily from the company's sales in Canada, though some government funds have been received.

R&D expenditures amounted to approximately five per cent of the company's sales volume in 1977 and 4.6 per cent in 1978. In comparison, R&D expenditures in 1969 amounted to only 1.3 per cent of the sales achieved in that year. Approximately one third of these expenditures is for the adaptation of U.S.-made equipment, including PBXs and central office switches.

AEL developed two products in Brockville during the 1960s. One was a small SPC crossbar central office switch called the C-1 EAX. The other was a switching system designed for use in apartment buildings and business premises. The latter product is known as the Enterphone system. During the 1970s, the company worked on equipment which is generally outside the range discussed in this report. The company's role in the area of digital switches was allocated to it by its parent as part of one overall R&D activity of GTE (U.S.) in this equipment area.

### (3) Mitel Corporation

Mitel Corporation was founded in 1971 by two former employees of the Bell/NTL group. It began operations in 1973. At the outset, Mitel designed, manufactured and marketed tone signaling equipment. Initially, it was a privately held company; shares were offered to the public in July 1979.

Since its inception, the corporation has expanded the line of products which it designs, manufactures and sells. With the exception of the latest product, a PBX, Mitel's products largely fit into "gaps" which were perceived to exist in the product lines of other manufacturers. According to Mitel, however, the basis of the corporation's initial success was innovative designs which employed off-the-shelf components and which replaced equipment already being sold in the industry.

### (a) Financial and Statistical Summary

Mitel's sales from the start of operations to date are shown in the following table.

TABLE 8

MITEL SALES (1973-81)

| Year | Total Sales ($ millions) |
|---|---|
| 1973 | 0.012 |
| 1974/75 | 0.3 |
| 1975/76 | 1.5 |
| 1976/77 | 5.4 |
| 1977/78 | 11.5 |
| 1978/79 | 21.6 |
| 1979/80 | 43.4 |
| 1980/81 | 111.2 |

In 1973, Mitel had facilities in Kanata, Ontario only. Mitel stated that by 1976, approximately two thirds of total sales were accounted for by exports. The growth which occurred in the 1978 to 1980 period is attributed to sales of Mitel's PBXs.

The number of people employed by Mitel grew from four in 1973 to over 300 by December 1977, and to more than 2500 in 1981. Mitel's operations involve substantial subcontracting which has allowed achievement of the growth rate shown above.

In 1977, the tone-to-pulse converter accounted for approximately 50 per cent of the $12 million sales made, and the automatic dialer, approximately five per cent. These and other products have continued to represent increasing sales dollars to Mitel, but the percentage of total sales they accounted for has declined because PBX sales have become dominant.

Mitel sells to virtually every telephone company in Canada. Over the period 1975 to 1979, inclusive, Bell Canada accounted for an average of approximately 12 per cent of Mitel's Canadian sales. These varied from year to year. Mitel's sales in the United States are significant, amounting to approximately 58 per cent of total sales in 1978, and 61 per cent in 1979. AT&T purchases accounted for some 50 to 60 per cent of Mitel's U.S. sales.

### (b) Product Range

Mitel's range of equipment includes terminal equipment and equipment for the network, as well as semi-conductor products. A type of equipment which is difficult to classify is Mitel's Quadverter. This system "connects Touch Tone signals to rotary dial pulses and outpulses them at the correct rate to the central office switching equipment". The Quadverter is designed to be located at the central office. However, an alternative technical solution is the conversion of the signals using equipment located in the telephone set.

Mitel sells products which can be used to augment features available on a user's existing equipment. An example is what Mitel calls "key system intercoms", equipment which provides intercom signaling for KTSs. Mitel stated that this equipment is compatible with all "standard" KTSs and can be used to supply conference calling and paging features. Also included in this category are Mitel's line event recorders. This equipment monitors calls, records the numbers dialed and the amount of time for which lines are in use. Mitel also offers a speed dialer which can be connected to the lines of single-line telephone sets, KTSs and PBXs. A final type of equipment in this category is toll denial equipment.

Mitel has a family of PBX products in the small size range: the SX-200, the SX-100, the SX-20 and the recently introduced SX-10. These incorporate digital techniques to perform controlling functions, but the switching system is based on electronic, space division techniques and the signals are in analogue form.

The SX-200 was the first to be developed, in Canada primarily. Mitel claimed that this PBX is compatible with all standard central office switching systems and telephone sets and can be connected with up to 208 internal lines, or 104 external lines, or some combination of both, although in its usual application approximately 160 lines or less would be connected. This PBX operates with microprocessors. The features available on the SX-200 are totally dependent on software, of which there are five different packages available. This is Mitel's largest PBX, yet it is significantly smaller than other available PBXs.

The SX-100 is a reduced version of the SX-200. The technology incorporated in this product is identical to that discussed previously. The PBX has one half of the lines and trunks of the SX-200, but has all of its features. It requires much less power and is less than one half of the physical size of the SX-200. The SX-100 is used for installations requiring up to 80 internal lines.

Mitel's SX-20 is an even smaller PBX, related to the other two in that it is an analogue, switched, but digitally controlled PBX. There is a difference in that the lines and trunks of the small PBX are not interdependent, as they are in the SX-200 and SX-100. The SX-20 is for installations requiring up to 50 lines, or a maximum of 72 internal lines. It is the size of a small briefcase. At the time of Mitel's appearance in November 1979, it had trials in the field. The line card incorporated in the SX-20 provides for an interface for up to 24 lines and can contain from 100 to 1000 components. This compares to competing line cards of other companies which provide for up to four lines. Mitel stated that its line card also includes switching. It was indicated that Mitel has found broad patent coverage for these innovations.

The SX-20 represents one of the smallest PBXs discussed during hearings, if not the smallest. Mitel indicated that it would compete with KTSs.

Since Mitel's appearance, the company has introduced the SX-10, a mini PBX, which handles 10 private lines.

Mitel feels that its SX-200 is as large a PBX as it would manufacture with analogue switching techniques because cost considerations require the use of digital techniques for larger line sizes. Mitel was developing an SX-2000, a large digital PBX expected to be available sometime within the next few years. This PBX is designed to serve large businesses and lodging establishments requiring from 100 to over 20,000 extension lines.

### (c) Manufacturing Facilities

Mitel has three manufacturing facilities in Canada; two are in Kanata, Ontario, and one is in Bromont, Quebec. The product line discussed above is manufactured in Kanata; the Bromont facilities produce custom ICs (integrated circuits) as well as commercial ICs.

Mitel operates one plant in Boca Raton, Florida, for the production of PBXs. The assembly of PBXs and PCBs proceeds in Ogdensburg, New York (Mitel Inc. and Mitel Semi-Conductor Co.). There are manufacturing facilities in Deerfield Beach, Florida (Mitel of Delaware, Inc.), in

Catano, Puerto Rico (Mitel Caribe Inc.), Shannon, Ireland (Mitel International Limited), and in Slough, England (Mitel Telecom Ltd.). Assembly of PBXs and manufacturing of receivers and converters are carried out at the four latter locations. In Asia, the company has offices in Hong Kong and Japan. Mitel controls all the above companies through Stellar Holdings (Nederland) B.V. and Lunar Holdings (Nederland) B.V., located in Amsterdam, The Netherlands.

Mitel is currently planning further expansion in Canada and in other countries. For example, an important plant is being established in Wales, England, where products will be developed and manufactured expressly for the British telecommunication needs.

### (d) Research and Development

Mitel's R&D covers the range from product identification through production. Mitel is active in the area of LSI devices and hybrid and other circuitry. It is also active in the application of microprocessor technology. In addition, Mitel does development work on manufacturing processes, including automatic assembly processes and programming manufacturing equipment.

Approximately 90 per cent of Mitel's R&D occurs in Canada, particularly in Kanata. All of Mitel's senior management and all product development are located in Canada.

Expenditures on R&D expressed as a percentage of its sales amounted to 14.3 per cent, 13.25 per cent and 10 per cent of sales in the years 1977, 1978 and 1979, respectively. The greatest part was for the development of the SX PBX products. Expenditures are expected to remain close to the 10 per cent figure, which is in line with the industry average. In 1978, R&D expenditures amounted to some $1,528,000; expenditures in 1979 amounted to $2,820,000, and in 1980, to $5,138,000.

Some of the R&D programs undertaken by Mitel were funded by the federal Government. For example, in 1979 just over $1 million worth of R&D activities were funded by the government. These are included in the figures cited above.

Mitel did not expect this funding to be as significant in the future because the projects involved were nearing completion. Some of the funds received by Mitel from the government were used to acquire research-oriented assets for semi-conductor facilities, as well as assets for production facilities.

Mitel stated that R&D activity in product areas in which it is engaged does not require a large organization and that a company need not be the size of NTL to compete internationally if it specializes. Witnesses were not concerned with the ability of larger companies to spread the risk of R&D activities and indicated that a small company can change direction much faster than can a large company. Mitel did state, however, that there are significant economies of scale in research and development activities related to electronic PBXs. In so far as product development is concerned, Mitel does not perceive any problems attributable to the company's not having an ownership relationship with a telephone company. It was stated that every large North American telephone company was consulted in developing the SX-200. Testimony did indicate some delay in obtaining a test line from Bell Canada for this product.

### (4) A.E.I. Telecommunications (Canada) Limited

A.E.I.'s predecessor, Siemens Brothers (Canada) Limited, was formed in 1924 in Winnipeg. A.E.I. (Associated Electrical Industries) took control of Siemens Brothers shortly after World War II and changed its name in the early sixties. In 1967, General Electric Company, Ltd. (G.E.C.) of Great Britain took over A.E.I. It remains a wholly owned subsidiary of this large foreign multinational company.

A.E.I.'s principal business activity is the sale and installation of PBX and central office switching equipment. A.E.I. also assembles and sells a manual switchboard used by telephone answering firms. The company's sales in 1975, described by A.E.I. as an extraordinary year, amounted to some $20 million; in 1976, to $11.9 million.

The switching equipment obtained from its parent was step-by-step switching equipment, which it assembled in

Winnipeg until the equipment became obsolete. Since 1970, A.E.I. has had an agreement with Nippon Electric Co. giving A.E.I. exclusive Canadian distribution for that company's PBX and central office switching products. A.E.I. assembles a small quantity of PBX equipment for Nippon.

A.E.I.'s manufacturing facilities are located in Winnipeg and were said to be more of a support than a primary production operation. It inserts electronic components and performs the final assembly. Printed circuit boards and sheet metal work are obtained under subcontract. During its testimony, A.E.I. referred to only one telecommunication product for which the company had undertaken research, development and production in Canada. This is the ANIPAK, an automatic number identification system for long distance calls used in step-by-step central offices. Of approximately 100 people employed by A.E.I. at time of testimony, 60-70 per cent were involved in the production of this system.

A.E.I.'s R&D expenditures have historically amounted to approximately two per cent of the value of its annual sales. Although ANIPAK was developed by A.E.I., the company said it was not inclined to develop major systems since this would take millions of dollars.

### (5) Plessey Canada Limited

Plessey Canada Limited is a wholly owned subsidiary of The Plessey Company Limited of England. Plessey U.K. has a wide range of telecommunication products, including terminal equipment, PBXs and central office switches. Plessey Canada was formed in 1962 through the amalgamation of two companies which had been marketing products made in the U.K. In the mid-1960s, Plessey Canada mainly imported telephone equipment for resale.

Plessey Canada is now the designated Plessey production center for small electronic PBXs. The company supplies radar equipment, military communications and distance measuring equipment in addition to telecommunication products. Its sales for fiscal year-end March 1978 were almost $8.5 million. Approximately $7.5 million were revenues from the sale of telecommunication products.

Plessey Canada's major product is the K-1 electronic PBX which is manufactured in this country. Although it was developed in Toronto, it was tested in the field in the U.S. Testimony indicated that delays had occurred when Plessey requested testing facilities from Bell Canada. At time of testimony in December 1978, the company considered Bell Canada's most recent offer inadequate in terms of the time period allowed for testing (60 days).

Plessey first introduced the K-1 in 1977. In 1978, when Plessey had 150 employees, it produced 100 K-1s. Plessey sold about 98 per cent of these outside Canada. When the company's representatives testified before the Commission, they anticipated similar results for 1979. Plessey sold the K-1 primarily in the United States although it sold its equipment to telephone companies in other parts of the world.

### (a) Products

The K-1 electronic PBX is for installations requiring less than 100 lines. It provides both KTS and PBX features. Incorporated in the K-1 are time-division switching techniques for control signals and space-division switching techniques for voice signals. Because of the former, a modified telephone set is required with this equipment. In connecting the telephone sets to the user's switching equipment, the Plessey system makes use of a thin (4-wire) cable rather than the traditional thick, multi-wire cabling used with KTSs.

Twenty-eight different printed circuit cards are found in the K-1. Multiples of different types are used so that a PBX connecting, say, 100 lines would have approximately 50 cards within it. Installation and testing of the K-1 take approximately two hours.

Prior to the introduction of the K-1, Plessey Canada sold not only PBXs but also a variety of central office switching systems, both urban and rural, as well as telex switching systems. The PBXs sold in this period were introduced in 1973 or 1974. They were small crossbar switches with a maximum line capacity of 120. All of the about 50 units made, were sold in Canada. This product, too, is obsolete and has been replaced by the K-1.

### (b) Manufacturing Facilities

The manufacturing operation for the K-1 is one of final assembly and testing, carried out in Plessey's plant in Toronto. Plessey contracts out to other companies for the manufacture of parts and for the insertion of components into printed circuit boards. Computer Assembly Systems, Limited (CompAS), of Brockville, inserts the components into the cards which Plessey obtains from three or four suppliers. Plessey does its own testing using automatic testing equipment. The company obtains most of the componentry required for the K-1 from the U.S. It obtains the basic telephone set from ITT Canada Limited and modifies it.

Plessey Canada also manufactures solid-state ringing and tone equipment for central office switches. The company is considering the importation of digital central office switches from Stromberg-Carlson in the United States.

### (c) Research and Development

Plessey Canada developed a crossbar PBX and the K-1. The R&D related to the former was not discussed during hearings.

Development of the K-1 began in 1976 and continued without assistance from any other Plessey subsidiary. Research and development expenditures amounted to less than $2 million. Of this, Plessey Canada contributed $1.25 million and obtained the remainer from the Canadian government.

Plessey stated that its gross R&D expenditures amount to 10 per cent of the company's sales. When the amounts provided by government are excluded, the net R&D expenditure is approximately five per cent. Plessey Canada is spending approximately $400,000 per year in research and development. This company felt that a small company can undertake the necessary R&D activities required for electronic equipment. Plessey has been successful with its K-1 PBX and is proceeding with other developments.

### (6) Siemens Electric Limited

Siemens Electric Limited, active in Canada since 1892, is a wholly owned subsidiary of the German-based Siemens A.G., which is among the five largest telecommunication equipment suppliers in the world. In Canada, Siemens is involved not only with telecommunication equipment, but also with power systems, instrumentation and components, and medical equipment. Its Canadian telecommunication activity commenced in 1954.

In 1977, the electronics division of Siemens Electric Limited had sales of approximately $10 million. Some one third of this is accounted for by telecommunication equipment, a figure which includes sales of equipment such as switches for telex and central office switching equipment of the type used for the CNCP data telecommunication network. Of the 350 employees of Siemens in Canada, 50 are engaged in the area of telecommunications.

Siemens' equipment includes PBXs, teleprinters, telex switches, switching equipment with central office-type functions for use in data telecommunication networks, and some non-voice terminals.

Although Siemens sells a variety of PBX products world-wide, only the SD-192 and the hotel/motel version of it, called the SD-232H, are available in Canada. The SD-192 can be connected with up to 192 internal lines and 48 trunks. Up to 232 internal lines may be connected in the hotel/motel version. This PBX is a small, stored-program controlled, electronic switch incorporating space-division switching technology. It carries signals in analogue format although the equipment can carry both voice and data signals. PBXs for installations requiring up to 20,000 lines are being developed in Europe and are to be based on improved crossbar technology. Siemens expects to introduce these in North America.

Siemens has an extensive product line in the area of non-voice terminal equipment. The company offers a number of teleprinters for use with telex telecommunication networks and other applications. Newer versions of this equipment incorporate electronic technology to replace previously mechanical equipment. Siemens also offers a number of terminal equipment systems which closely resemble PBX equipment. Siemens' System 102 extends the telex network within a corporate organization, providing desk-to-desk telecommunications for internal correspondence. Siemens' TWK system for small installations is a PBX-style data system. The company's ESK system combines telephone terminal equipment and data communication equipment enabling data signals to be transmitted between telephones and data terminals. Transmission may be internal to the premises, or may take place over the public telephone network or private lines. Telephone dictation systems, computer peripherals and a paging system can be used with the ESK. Siemens also offers a modem, the GDN 4800, for use in data transmission.

The SD-192 is manufactured in the U.S. No Canadian sales of this equipment had been made at the time of Siemens' appearance before the Commission. Since then, Siemens has obtained a contract from Bell Canada and is now establishing assembly and testing operations for the SD-192 in this country. Siemens carries on some R&D here. Multiplex equipment was cited as an example of it. The company indicated that, even if it had fuller access to the Canadian market, most R&D would continue to be done in the United States or Germany. Canadian activities would be confined to the development and application of existing products for sale in Canada.

### (7) LM Ericsson Limited

LM Ericsson Limited appeared quite early in the inquiry. It is a wholly owned subsidiary of Telefonaktiebolaget LM Ericsson of Sweden. Operations in Canada commenced in 1953 and the company's main activity is telecommunications. The U.S. and Canada together accounted for two per cent of total sales in each year of the period 1972-76, inclusive. The following table shows Canadian sales for 1970, 1975 and 1976.

## TABLE 9

## LM ERICSSON SALES (1970,1975,1976)

| | ($ thousands) | | |
|---|---|---|---|
| | 1970 | 1975 | 1976 |
| Total Sales | 3,400 | 11,700 | 11,500 |
| Telecommunication Sales | 2,700 | 6,700 | 5,400 |
| PBXs* | | 5,700 | 3,900 |
| Rural Switches | | 136 | 216 |
| Intercoms and PXs** | | 175 | 32 |
| Telephone Sets | | 63 | 60 |

* All but five units sold in 1975 were crossbar PBXs.

** PX: private exchange.

As at December 1, 1977, LM Ericsson employed 54 people in Canada. For comparative purposes, it was indicated that LM Ericsson's U.S. sales in 1976 amounted to $12.1 million.

LM Ericsson does not manufacture telecommunication equipment in Canada although it undertakes some product assembly and some equipment adaptation. It has facilities to train customers in equipment operation and maintenance.

The telecommunication equipment available from LM Ericsson in Canada includes telephone sets and PBXs as well as intercoms. The PBXs incorporate crossbar switching techniques,* and the various products can be used in installations requiring from 50 to 9000 lines. Centrex is available on the largest PBX. The company expected to introduce an electronic PBX in 1979 with a maximum line capacity of 100. LM Ericsson intercoms can be connected with up to 5000 stations, and to mobile radio and internal paging systems as well.

LM Ericsson does not engage in telecommunication R&D activities in Canada.

### (8) Rolm Corporation of Canada Limited

Rolm Corporation of Canada Limited is a subsidiary of the Rolm Corporation of the U.S. which was formed in 1969 to sell small military (specification) computers. A telecommunication products program began in 1973 and the first shipments of these products were made in April 1975. In 1978, the U.S. Rolm had telecommunication sales of $32.3 million, which was almost 65 per cent of the company's sales for that year. Over 95 per cent of total sales (computers and telecommunication equipment) are in the U.S. where Rolm has three wholly owned subsidiaries which are interconnect companies.

The Canadian subsidiary has been engaged in the sale of telecommunication products since 1977 but had had limited success at the time of its appearance (November 1978 and April 1979). Rolm has no manufacturing facilities in Canada.

Rolm's telecommunication equipment consists of four related models of PBXs and an electronic telephone set which operates in conjunction with them. The PBXs are designated as CBXs (Computer Branch Exchanges) and are available in various size ranges. The CBX was first introduced in April 1975 and was a traditional PBX into which Rolm's computer was integrated. It also incorporated digital switching technology using a time-division switching technique and pulse code modulation. The CBX is for installations requiring the connection of 100 to 800 lines. The SCBX (Small CBX) was first shipped in October 1977 and is intended for installations of 48 to 144 lines. The first shipment of the LCBX (Large CBX) was expected in December 1978. This PBX is for installations of 1500 to 4000 lines. New software programs have been introduced by Rolm approximately yearly. Rolm's electronic telephone set, the ETS-100, has a built-in general purpose microprocessor and a LED display.

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* The parent company pioneered crossbar switching technology. Switching equipment incorporating this technology constituted the major type of switches manufactured by LM Ericsson. Rural, urban and transit crossbar switches have been sold in Canada.

At the time of Rolm's appearance, the transmission of data through Rolm's PBX required the use of modems, a requirement which Rolm was attempting to eliminate.

Rolm's R&D expenditures in the U.S. amounted to approximately 12.5 per cent of net sales in 1974 and 1975, 10.1 per cent in 1976, 8.9 per cent in 1977, and 7.6 per cent in 1978. The relatively low figure for 1978 was explained by sales growth which exceeded the rate at which Rolm could hire and train R&D personnel.

### (9) Wescom Canada Limited

Wescom Canada Limited is a wholly owned subsidiary of Wescom Incorporated of Chicago, Illinois, which was established in 1965 and acquired in 1980 by Rockwell International Corporation. The latter company also owns Collins Canada, a company which manufactures automatic call distributors and PBX tandem switches.

Wescom Canada's most important equipment is voice-frequency equipment used in telephone company central offices. Its next most important products are PBXs and transmission equipment. The company began by developing equipment to fill "gaps" in the product range available on the market. It is currently entering the PBX area and also expects to have switching equipment suitable for small central office applications.

Total sales in Canada and the U.S. are approximately $100 million. Wescom Canada employs approximately 50 people, with 15 in sales and up to five or six in assembly.

Wescom Canada distributed small analogue PBXs, introduced in late 1972 or early 1973. These were for general business applications (#501) or for hotel/motel applications (#502) and were suitable in installations requiring from approximately 60 to 300 lines.

This line of PBXs had been discontinued at the time of Wescom Canada's appearance before the Commission in 1978. A newly developed digital PBX, the 580, was being field-tested in the U.S., but not in Canada. This PBX incorporates time-division switching techniques and is designed for installations requiring between 120 and 2400 lines. It includes an automatic call distribution (ACD) feature. Wescom stated that this PBX would launch the company into small Class 5 central office switching equipment.

Very little manufacturing is undertaken in Canada and apparently none which involves terminal products. The Canadian operations were described generally as product packaging because of small sales volume. Wescom stated it was considering further equipment manufacture in Canada related to central office switching equipment.

R&D activities in the United States, also directed toward the development of products to fill "gaps" in the product range available to the industry, amount to 5 to 10 per cent of sales. The activities in Canada were said to be very minor.

The R&D costs associated with the development of the 580 PBX were characterized as considerable, more than five per cent of total company sales, and involved more money than Wescom normally spends on R&D projects.

### (10) ITT Canada Limited

ITT Canada Limited (ITTC), a subsidiary of International Telephone & Telegraph Corporation (ITT), entered the

Canadian telecommunication industry in 1948 or 1949. It had been active in other areas in Canada since the late 1800s. Its telecommunication facilities were initially in Montreal but were moved to Guelph in the mid-1960s where the main manufacturing facilities of the Communications Division of ITT Industries of Canada Limited, a subsidiary of ITTC, are now located.

Other than telecommunication equipment, the principal areas in which ITT is engaged are: insurance and financial services, manufacturing of various products, natural resources and consumer products. World-wide, telecommunications constitutes the largest activity of ITT, but this is not so in Canada. ITT has manufacturing facilities in over 24 countries. In 1976, total sales of telecommunication equipment amounted to approximately $3.4 billion (U.S.).

ITTC's sales totalled $450 million in 1978. Approximately $25 million were accounted for by sales of telecommunication equipment, excluding component sales, up from $6.6 million in 1969. One third of telecommunication equipment sales consists of telegraph equipment products, and some $5 million accrue from exports. Imports from other ITT companies and elsewhere amount to $15 million per year.

Since 1967, the value of voice terminal equipment sales, which began in 1966, has exceeded the value of sales of transmission and central office switching equipment. Well over 80 per cent of ITTC's telecommunication equipment sales have been made to the telcos on the Prairies and to CNCP.

ITTC has been exclusively assigned KTS development within ITT. In 1978, approximately 400 of ITTC's employees were involved in telecommunications. Of these, 310 were located in Guelph and 74 in Regina and Winnipeg. Forty of the employees in Guelph were active in R&D.

### (a) Product Range

World-wide, ITT manufactures a full range of the telecommunication equipment purchased by telephone companies and other types of telecommunication companies. Although a limited range is manufactured in Canada, a relatively complete range of equipment is manufactured in the U.S. and is available for sale in Canada.

ITT manufactures the standard 500-type telephone set designed by Western Electric, which is also manufactured by Northern and Automatic Electric. It also manufactures a traditional six-button telephone set for use with KTSs. PCBs for KTSs are manufactured and sold separately. At the time of its appearance, ITTC was distributing Western Electric's "Trimline" telephone sets and had just introduced telephone sets of proprietary design. In Europe, ITT has developed an electronic telephone set which is apparently not available in Canada.

From the mid-1960s to the late 1970s, ITTC sold a family of KTSs which it denoted by the letters CK, some of which were designed in Canada. In the late 1970s, ITTC designed and introduced its MKS family of KTSs. The variety of CK KTSs available from ITTC was for installations requiring connections with up to 3, 4, 16 or 24 external lines and, respectively, with up to 1, 10, 16 or 36 internal lines. All but one of the KTSs provide one direct intercom link to which access is gained by a push button. The exception provides for four direct intercom links. At least some of the equipment is designed to work with Western Electric's 1-A1 and 1-A2 KTS equipment. The largest CK product uses solid-state technology on printed circuit boards. This equipment is produced in the U.S.

ITTC's MKS KTS, of modular design, is electronic and uses digital signaling techniques. Telephone sets are connected to centralized equipment by means of four wires rather than multi-pair cabling. There are three MKS products permitting connection with up to 6, 12 or 20 external lines, and respectively, 12, 24 or 48 internal lines.

The advantages claimed for four-wire connections and modular design are that they significantly decrease installation costs. Digital signaling permits flexibility in assigning internal lines, external lines and features to the buttons on the telephone set.

Printed circuit boards, installed on the centralized equipment of the MKS, provide all the connecting and signaling circuitry required to operate the telephone sets. The largest model, the MKS-162, was characterized as having the largest line size among comparable KTSs in the world. The KTSs have been modified for sale in the U.S. to telephone companies by an ITT subsidiary which also manufactures the equipment.

ITT's TD-100 is a PBX developed in Guelph for installations requiring up to 100 lines. This PBX reached the pre-production stage in Canada in 1972 but was then transferred to the U.S. ITTC cited a labour strike and insufficient manufacturing capacity as factors underlying this decision.

ITT in the U.S. also designs and manufactures versions of a PBX called the TE-400. This PBX is electronic and can be connected with up to 400 lines. It is available for sale in Canada.

Data and other services can be made available on ITT's PBXs. Hotel or motel installations are not offered by ITT.

### (b) Manufacturing and R&D

Only telephone sets are manufactured in the Regina and Winnipeg facilities which were constructed to serve Sask Tel and MTS, respectively. In consequence, some of the same operations are carried out in both facilities.

The standard 500-type and KTS telephone sets are assembled in Winnipeg. Some component parts such as plastic moulds are obtained from Canadian subcontractors. Other components, characterized as being mainly those for which expensive tooling is required, are obtained from ITT's U.S. telephone set manufacturing facility in Corinth, Miss., where the components are produced in high volume. All the operations carried out in Winnipeg are also undertaken in Regina where, in addition, rotary and touch-tone dialing mechanisms are assembled.

In Guelph, ITTC manufactures KTS line cards (PCBs), the DM32S transmission equipment, a concentrator used in suburban areas, and some central office equipment. Presumably, the central office KTS equipment is all manufactured in Guelph.

ITTC stated that it imports central office switches and transmission equipment, and other equipment where Canadian sales do not justify manufacture.

The initial ITT KTSs introduced in Canada in the mid-1960s were based on Western Electric designs and manufactured under licence. Noting that technology had advanced beyond what was available in the Canadian market, the company began designing KTSs here. There resulted some of its CK line of KTSs, such as the CKE36A4 KTS developed in 1968 or 1969. Due to lack of sales in Canada, and barriers to the sale of Canadian-made equipment in the U.S., the product is currently not manufactured in Canada. The latest KTS equipment designed in Canada was the MKS family. This technology has been distributed to ITT manufacturing facilities in the U.S.

### (11) RCA Limited

RCA Limited in Canada is a subsidiary of Radio Corporation of America. The Canadian subsidiary manufactures and distributes numerous electronic products. These have included microwave relay and satellite equipment.

Sales by RCA Limited amounted to approximately $200 million in 1978, when some 2,500 people were employed. Sales of telecommunication equipment were relatively small. During the 1970s, the company reduced its product line. In 1977, RCA Limited sold its satellite facilities to Spar Aerospace Products Ltd.

Although RCA Limited does not sell terminal equipment in Canada, the U.S. RCA distributes PBXs and KTSs. It also sells call detail recording systems, data access arrangements (the equipment interface between modems and the telecommunication network) and wake-up systems.

In 1974, RCA introduced a PBX of its own manufacture called the RCA-600 which was withdrawn from the market in 1975 or 1976. The company now distributes in the U.S. a range of PBXs of other manufacturers, including both small and large PBXs. It also distributes KTSs ranging from small ones to models having over 2,400 lines.

RCA Limited has no R&D activities in Canada related to terminal equipment.

### (12) Philips Electronics Ltd.

Philips Electronics Ltd., with headquarters in Toronto, is ultimately owned by Philips Lamp Holding Company of The Netherlands. This company is active world-wide in the manufacture and supply of telecommunication equipment.

Total sales of Philips Electronics in Canada exceeded $100 million for the first time in 1974 and were $137.4 million in 1976. Philips supplies a wide range of electrical and electronic products. Among these are consumer products, medical equipment, components, as well as telecommunication equipment.

In the terminal equipment area, Philips markets telephone answering equipment, radio paging equipment, a message switch, an analogue PBX, and some data terminal equipment. Most of this is imported. Intercom equipment has been marketed in Canada since 1971.

Philips maintains sales and service offices across Canada for the products it sells, including its PBX. The sales of this product appear to have been very small. It carries out R&D activities in Canada but none related to these telecommunication products.

### (13) Farinon Canada Limited

Farinon Canada Limited, located in Dorval, Quebec, is a wholly owned subsidiary of the Farinon Corporation of the U.S., recently acquired by Harris Corporation in the U.S. Farinon Canada was established in 1964 to offer a line of transmission products and later, radio products. Total Canadian employment is somewhat less than 300. Its manufacturing and R&D are unrelated to terminal equipment.

Farinon Corporation of the U.S. owns Digital Telephone Systems, Inc., which sells some terminal equipment, including PBXs, also sold by Farinon Canada since 1977. These are produced in the U.S. Farinon sells two PBXs in Canada, the D1200 and D1203. Both are digital, incorporating time-division switching technology. The D1200 is available in three sizes: 120, 520 and 1000 lines and trunks. It was stated that the system can be installed in a few hours and is expandable by the addition of modules. Most maintenance occurs by on-site replacement of "plug-in" modules. The D1203 PBX is a more recent product intended for installations requiring from 40 to 144 lines and trunks. This PBX utilizes the common control equipment of the D1200 with which the plug-in modules are interchangeable.

Digital Telephone also offers line usage meters, a traffic data recording system and a subscriber line system, in the U.S. at least. The latter is a multiplexing and switching system for use with up to 240 telephone party lines in areas five miles or more from a telephone company's central office.

### (14) Technex International Ltd.

This company was established in 1972 to distribute electronic components. This activity still accounts for a significant portion of the company's sales. Technex began manufacturing telephone sets in 1973 and intercoms in 1974. In September 1975, the company was incorporated in the U.S. as the Tele-Devices Corporation. Since that time, the bulk of the company's telecommunication activities has been transferred to the U.S.

Technex sells a single-line telephone set, the "Aster", and another, the "Commodore", with a speakerphone which permits conversation in both directions simultaneously.

Both of these products are based on a telephone set of Polish design and are being replaced by a product of more modern design, the "Modulus III". Technex also sells a "Satellite" unit which provides a full duplex, handsfree speakerphone feature.

Technex's "Minicom" is an internal telecommunication system to which up to eight Aster telephone sets can be connected. An internal paging system can also be connected to it. Although Technex offers the Minicom for use separately from the telephone system, it can be operated with telephone sets which are connected to the public network.

Technex's Canadian manufacturing operations, in Saint-Laurent, Quebec, were initially an assembly operation using imported components. It is not clear to what extent this has changed. Some 10 per cent of the value of the speakerphone is accounted for by Canadian operations, and in excess of 80 per cent by American components.

The major part of Technex's manufacturing is now located in Plattsburg, New York. The components used there are mostly of U.S. origin.

Technex developed a series of proprietary designs in telephone sets and intercoms. The development of its speakerphone equipment is considered a major innovation by Technex.

The only other R&D activity cited was the adaptation of the Polish telephone (the "Aster") to North American requirements.

### (15) Canadian Motorola Electronics Company

Canadian Motorola Electronics Company is a division of Motorola Electronics Sales Limited, itself a wholly owned subsidiary of Motorola Canada Limited, whose head office is in Willowdale, Ontario. Motorola Canada Limited is a wholly owned subsidiary of Motorola International Development Company which, in turn, is a subsidiary of Motorola

Incorporated of Delaware. Motorola Incorporated has manufacturing plants for communication equipment world-wide.

The Canadian company has four divisions: Electronics, Automotive Products, Semiconductor Products, and Military and Aerospace Electronics. Employment in Canada is about 1,100 people. The company adapts products designed in the United States for the Canadian market. The products sold in Canada were described as essentially the same as those sold in the United States, with minor variations to conform with DOC specifications.

Canadian Motorola sells mobile telephones and radio components, pagers and components, walkie-talkie radios, base stations for radio systems, CB radios and portable radios. Customers include all the major provincial telephone companies, radio common carriers engaged in paging or dispatch service, the police forces generally, CNCP and others.

The company produces components for two-way mobile radio systems, including both simplex and duplex radio units. The duplex radio unit, the "Pulsar", is the radio portion of Bell Canada's AMTS system or Access 450. Motorola also sells Bell Canada a mobile radio called the "Mocom-35". Most of Motorola's mobile telephone equipment is sold to end users.

Motorola offers a full range of pagers: tone-only pagers, tone-and-voice pagers, signal-plus-vibration pagers, one-address or two-address pagers. These are sold to most telephone companies (but not to Bell Canada for its large system called "swap") and to radio common carriers which constitute Motorola's largest market for pagers. It also sells pagers to business firms for use in plants or buildings.

Motorola spends three per cent of its sales on product design. The international figure for research and development for Motorola is seven to eight per cent of sales and includes dollars spent on more basic research.

Canadian Motorola makes much of the equipment it sells. It imports CB radios, components such as semi-conductors which it distributes, and some of its mobile-telephone products. It was stated that, when sales in Canada do not warrant a Canadian manufacturing operation, the product is imported from the parent company in the United States or from one of Motorola's manufacturing operations outside the United States.

Perhaps 20 per cent of the cost of Motorola's Canadian products is accounted for by imported components. It was indicated that Motorola could buy printed circuit boards of excellent quality successfully in Canada but that there was no direct source in Canada for semi-conductor devices. The firm imports most capacitors and resistors from the United States. The company buys some crystals in Canada but imports some from Motorola in the United States. Exports were nominal in relation to overall sales at time of testimony.

### (16) International Systcoms Limited

International Systcoms Limited has its head office in Montreal and regional offices in Toronto, Edmonton and Vancouver. Controlling interest is held by Innocan Investments Ltd. of Montreal. International Systcoms began operations in 1958.

In 1978, sales reached $8 million. Export sales in that year totalled $1.7 million and included exports of $500,000 to the United States.

In April 1978, the company employed over 200 people. Between 140 and 160 were engaged in manufacturing and 17 were employed in research and development.

The company's three basic lines of equipment are mobile telephone equipment, two-way dispatch radios (also referred to as a private mobile line) and rural point-to-point radio telephones. Of the company's Canadian sales, over 90 per cent are made to telecommunication carriers. AGT was said to be one of the largest customers of International

Systcoms. Others were B.C. Tel, MT&T, Sask Tel, MTS, NBTel, Newfoundland Telephone and CN. At time of testimony, sales to B.C. Tel had dropped off. Although Bell was not then buying from International Systcoms, it was the most important purchaser in 1975. The company's mobile telephone is also sold to dealers, including Challenge. The dial rural radio telephone system is sold chiefly in the export market which accounts for approximately 90 per cent of the company's customers for this product.

International Systcoms products are designed in Canada. The company manufactures the control head and the radio for mobile telephones, but not antennas. The company does not manufacture base station equipment. The shell of the mobile telephone is a Contempra shell bought from Northern Telecom.

### (17) Gandalf Data Communications Ltd.

Gandalf Data Communications Ltd. is an Ottawa company that has been active in the design, production and sale of telecommunication equipment since 1970. Gandalf produces limited distance transmission devices (modems) which utilize digital technology for data communications. It sells them to carriers or to end users who connect them to lines leased from the carriers or to transmission lines owned by themselves. Gandalf also supplies a PACX (private automatic computer exchange). Of the $5.5 million in sales for the fiscal year 1978, approximately 15 per cent were made to members of TCTS, one per cent to other common carriers and 34 per cent to other Canadian customers (end users); 37 per cent went to the export market and 12 per cent were resale products distributed by Gandalf. Gandalf has two affiliates: a manufacturing company in the U.S., as well as a separate company in the U.K. Total 1979 fiscal year sales are reported to be approximately $13 million.

### (18) Develcon Electronics Ltd.

Develcon Electronics Ltd. is another Canadian company which produces limited distance data sets. Develcon was established in 1974 and its head office and manufacturing plant are in Saskatoon, Saskatchewan. Sixty per cent of its sales were to the Western telephone companies and 40 per cent to end users at the time the company appeared before the Commission in November 1977. Testimony was that Develcon was interested in selling to Bell, but Bell was not forthcoming when approached for information on its equipment needs.

### (19) Leigh Instruments Limited

Leigh Instruments Limited, whose Waterloo Industrial Products Division is the former Marsland Engineering Limited, is the main supplier of teleprinters to CNCP. Leigh Instruments Limited is headquartered in Ottawa. Its three divisions - Industrial Products, Avionics and Frequency Control - had sales totalling close to $40 million in 1978. Marsland was acquired by Leigh in 1969, although it retained its name until June 1978. Leigh-Marsland's sales of telecommunication equipment for the year ending June 1977 were in the vicinity of $6.2 million, the bulk (over $5.2 million) being teleprinters and some spares. Most of the remainder represented sales of general audio equipment for which Bell and Northern were the largest customers.

Marsland acquired the rights to manufacture teleprinters in 1969 from Northern Electric which held the licence from Western Electric of the United States. Although Leigh supplies teleprinters to CNCP's Telex network, the TCTS companies purchase terminals from the Teletypewriter Corporation of Chicago, a Western Electric subsidiary.*

Leigh entered the U.S. interconnection market with its teleprinters in 1978. Sub-assemblies are supplied by its Waterloo plant for final assembly and testing in Syracuse. Sales of teleprinters for fiscal year 1979 were expected to be about $8.5 million, with about half in the U.S. Testimony was to the effect that Leigh was developing a microprocessor-based terminal, since the electromechanical technology of their main product line was lagging. Applications would address the telex-type market as well as the 120-character-per-second computer input/output market.

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* Marsland has sold a very small number of units to Northern and Automatic Electric.

Although Leigh was unable to sell teleprinters to the TWX market, Mr. L.W. Reist, Program Manager for Leigh Instruments Limited, was ambivalent when questioned about interconnection, stating that his company had more to lose in the larger telex market than it could gain in the smaller TWX market and would have to develop a new marketing approach for Canada if interconnection were allowed.*

### (20) Canadian Trans-Lux Corporation, Ltd.

Representatives of Trans-Lux Corporation of New York testified regarding the activities of Canadian Trans-Lux, which was founded in 1930. Trans-Lux Corporation of New York, which was formed in 1920, manufactures teleprinters. Trans-Lux entered this market in 1972 following the decision to allow interconnection on Western Union's telex and TWX services. The company manufactures an electronic teleprinter (the "TLT") which it markets to end users for use on Western Union's telex network.**

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* Much of the testimony of Leigh Instruments was in relation to Leigh's experience in developing (and losing the contract for) a custom teletype cluster controller for Bell. They had also attempted to interest Bell in their 120 cps terminal and in an intelligent cathode ray tube.

** Western Union itself supplies Teletypewriter Corporation terminals which it had on hand when the decision to allow interconnection was made. Trans-Lux also supplies terminals and tickers for commodities and securities trading, in addition to its cinema operations. Trans-Lux was planning to release a unit for the TWX network shortly.

Canadian Trans-Lux services the brokerage and stock market industry but had not entered the telex business as had its parent company in the U.S. at time of testimony. Interconnection restrictions prevented it from selling the Trans-Lux terminal to telex end users in Canada. Canadian Trans-Lux unsuccessfully attempted to supply the unit to CNCP, which uses the Extel teleprinter.

### (21) ESE Limited

ESE Limited is located in Rexdale, Ontario. It was founded in Canada in 1965, but in 1978, after a decline in sales from $3.5 million to $2 million, ESE was acquired by Codex Corporation, a Boston company which is a wholly owned subsidiary of Motorola. At time of testimony, ESE had 70 employees. Its major products were traffic data analyzer equipment and high-speed modems. ESE was developing a high-speed special purpose signal processor for processing sonar data under contract to the Department of National Defence and had developed a semi-automated method for gaining access to and testing dedicated circuits under contract to Bell.

### (22) Plantronics Canada Limited

Plantronics Canada Limited was the name of the former Frederick Electronics Canada Limited. Plantronics Canada was a wholly owned subsidiary of the American Plantronics Inc. at time of testimony. Plantronics marketed such of its parent's products as headsets and the Kentrox line of air-conditioning equipment, both of which are distributed through Automatic Electric. In addition, it employed 30 people in Montreal manufacturing certain products. One of these was telex switching system equipment. A second was the international model of the parent company's Vu-Set Data Terminal that Plantronics Canada had adapted to international standards. Others were a data interface (Universal Selector Model 7500) and a Telex Control Unit (Model 126). Plantronics' exports equaled 40 per cent of sales, which were roughly $2 million to $3 million in fiscal year 1977-78, the bulk of which was accounted for by the Vu-Set International. In the fall of 1980, Plantronics closed its Canadian manufacturing operations. The Frederick product line previously handled by it is now handled by Plandata of Montreal.

The two following companies manufacture and market door entry control systems. An issue in the testimony of both firms was the fact that they were not allowed to connect their systems to the Bell telephone lines in apartment buildings.

### (23) Mirtone Industries Ltd.

Mirtone Industries Ltd. of Downsview, Ontario, is one of these companies. It is 90 per cent owned by Mircan Industries Limited (established in 1963) which acquired it in 1973.

Mirtone Industries Ltd. manufactures intercom equipment for both office and home, fire alarm equipment, emergency evacuation systems, emergency voice communication systems, and equipment for apartment-house security. The trademark of the door entry control system using hard wiring is "Mirtone". Sixty to 70 per cent of the company's production is for apartments.

The company sells its products across Canada. It had reportedly begun to market effectively to the U.S. and other foreign countries at time of testimony. Annual sales of all intercom systems (not the apartment-type alone) were running at $100,000 per month at the end of the fiscal year which closed in September 1978. The company has 75 employees of whom 25-30 are in manufacturing and 10 in product development and design. Eighty-five per cent of the value of the product is Canadian.

Mirtone stated that Bell Canada would not approve its apartment entrance control and communication system and would not allow Mirtone to connect its product to Bell Canada's lines. Mirtone claimed that Bell had advantages stemming from its involvement at the design stage of apartment building construction and its provision of normal telephone service.

### (24) Telemaster Corporation

Telemaster Corporation is a small Ottawa company which also manufactures and installs apartment intercom-door opener systems. At time of testimony in October and December 1978, Telemaster had been active in apartment communications for approximately 10 years and had four employees engaged in assembly, installation and service. Testimony indicated that Bell was marketing an intercom system ("Enterphone", manufactured by Automatic Electric) in the Ottawa area using the existing telephone system and equipment in a building. Telemaster systems used separate conduits and installation was thus more expensive. Telemaster stated that it had developed a system ("Lobby-Phone") similar to that supplied by Bell, but could not offer it because of the interconnection restrictions.

# CHAPTER V

# INTERCONNECTION IN CANADA

## 1. Terminal Attachments

### a) Current Telephone Company Policies

Telephone company regulations restricting the attachment of customer-owned terminals to telco facilities are common in Canada. It is said that they serve to protect the network and its development and maintain lower charges for basic telephone service than would otherwise prevail. Bell Canada's general restriction is found in its General Regulations, Rules 7 and 9; Bell's Tariffs allow specified exemptions.

> "7. - Except where otherwise stipulated in its Tariffs or by special agreement, the Company shall provide and install all poles, conduits, plant, wiring, circuits, instruments, equipment, fixtures and facilities required to furnish service and shall be and remain the owner thereof, and shall bear the expense of ordinary maintenance and repairs.
>
> 9. - The Company's equipment and wiring shall not be re-arranged, disconnected, removed or otherwise interfered with, nor shall any equipment, apparatus, circuit or device which is not provided by the Company be connected with, physically associated with, attached to or used so as to operate in conjunction with the Company's equipment or wiring in any way, whether physically, by induction or otherwise, except where specified in the Tariffs of the Company or by special agreement. In the event

> of a breach of this Rule, the Company may rectify any prohibited arrangement or suspend and/or terminate the service as provided in Rule 35."

Like Bell, the other TCTS members (B.C. Tel, which has an identical Rule 9; AGT; Sask Tel; MTS; NBTel; MT&T; Island Tel; Newfoundland Telephone) permit the attachment of customer-provided equipment in certain cases only.

Upon the application of Bell to amend Rule 9, the CRTC rendered Telecom Decision 80-13 on August 5, 1980 in which it prescribed the "Interim Requirements Regarding the Adjustment of Subscriber-Provided Terminal Equipment". Before then, telephone company tariffs did not usually permit customers to attach subscriber-provided network-addressing equipment to their facilities. The most common network-addressing terminal is the ordinary telephone set. The General Tariff of Bell Canada as amended in October 1979 allowed the connection of customer-provided telephones to the company's facilities. These telephones may be automatic or manual, of antique or decorator type. They must be single-line, without push buttons and, in the company's opinion, must be "reasonably different from those that it regularly provides". Bell's attachment policy required, however, that Bell install its standard working parts in the customer-provided telephone housing or substitute its standard working parts for those with which the customer-provided set was equipped. The service charges were $42 in the case of a housing approved by Bell and $100 in the case of a substitution; in both instances the company retained the ownership of the working parts. More than 30 types of special housings have been approved by Bell. Since October 1, 1980, however, Bell has offered the complete phone for sale. Customers who prior to that date had bought the shell or housing only can now buy the working parts. With the present CRTC interim decision, customer-provided extension sets are allowed under certain conditions; the primary set is not within the scope of this decision provision.

The telephone companies generally permit certain items of equipment which do not address the network to be provided by customers and attached through connecting arrangements or couplers supplied by the company. In the case of the federally regulated telcos, equipment certified under the federal Terminal Attachment Program (TAP) can substitute for the coupler. TAP was introduced in 1976 and to date includes only specified categories of voice and data equipment which do not address the network. Included as of June 1980, were:

1. Plugs and Jacks
2. Multi-pin Bridging Adapters
3. Automatic Answering Devices
4. Automatic Answering and Recording Devices
5. Acoustically Coupled Devices
6. Tape Recorders
7. Dictation Units (2 wire)
8. Non Addressing Alarm Devices
9. Graphic Communications Equipment
10. Facsimile Equipment
11. Electro-Cardiogram Equipment
12. Modems
13. Dictation Units (complex)
14. Scramblers (voice and data)
15. Traffic Measuring Equipment
16. Call Restrictors

17. Handsfree Loudspeaking Devices
    - may be connected only if certified under the TAP program

18. Loudspeaker Monitoring Devices
    - may be connected only if certified under the TAP program

Bell Canada's General Tariff (4200) specifies that customer-provided inert equipment may be attached to its telephones (without the use of a protective device). Other equipment can be acoustically or inductively attached to its telephones. B.C. Tel and Sask Tel indicated that they too allow the acoustical or inductive connection of customer-provided equipment. Inert equipment includes labels, pencil-holders, shoulder rests, etc. Examples of equipment which can be acoustically or inductively attached are telephone answering machines, voice-recording equipment and data-transmission equipment.

The TCTS telephone companies provide private-line and specialized data-transmission facilities together with their public switched voice network services. There is a more permissive environment for the use of customer-provided equipment with the private-line and specialized data services (except in the case of TWX) than prevails on the public switched voice network. The main complaints the Commission heard or reviewed were with reference to the public switched analogue network. Network-addressing equipment is not required on dedicated facilities, where customers historically have been accorded more freedom to attach. In the case of the TCTS packet switched data network (Datapac), Mr. B.H. Tavner, General Manager - Network Services (Ontario Provincial), Bell Canada, indicated that customer-owned terminals could interface with this network and that no protective devices were used. Although Datapac is a switched network, it differs markedly from the analogue voice network in that the data cannot be sent unless specified protocols are followed. Mr. Tavner added that he thought that a number of the data terminals were covered in TAP. CNCP, which offers private-line and specialized data services in competition with the TCTS group, permits customer-provided equipment on its networks, with the exception of telex.

Bell's application to amend Rule 9 involves the addition of a section, 9(b), which specifies certification of equipment by the Department of Communications (DOC) as a means of obtaining permission to attach. This would extend certification to network-addressing terminals. While the application awaits final hearing and decision, the CRTC has ordered that network-addressing terminal equipment that meets at least one of three sets of technical standards - one being that of the FCC in the United States, which Bell has consistently maintained is inadequate - may be attached to Bell Canada's facilities.

Within provincial jurisdictions, a July 1980 decision of the Public Utilities Commission of P.E.I. denied an application by Garden of the Gulf Court & Motel, Inc. to permit it to attach a PBX that it proposed to buy to the facilities of The Island Telephone Company Limited. The Commission stated that in its opinion "'public convenience and necessity' would not be enhanced by the addition of privately-owned telephone equipment to the existing telephone network, . . ." Garden of the Gulf appealed this decision to the Supreme Court of Prince Edward Island. Judgment allowing the appeal was rendered on June 17, 1981. In the words of Mr. Justice MacDonald, ". . . the Commission's preoccupation with the concept of public convenience and necessity and the principle of the greatest good to the greatest number led it to consider a number of irrelevant matters." The only standard that should be given this case, he said, is "the test of 'reasonable and just', but this must be considered in light of the interest of the appellant and the respondent."

Chief Justice Nicholson wished to make it clear that the Commission and the telco "should realize that customer owned terminal equipment is a 'fact of life'. . ." The Court concluded that the Commission's decision be varied to allow the interconnection applied for. The order is stayed, however, pending the enactment by the telco and approval by the Commission of fair and reasonable regulations governing the connection of terminal equipment either owned or provided by customers to the telco's facilities.

*The Saskatchewan Telecommunications Act* provides that:

> "44.2 No person shall attach or connect or use in conjunction with any part of a telecommunication line of the corporation any attachment except as permitted by, and subject to the conditions established in, the regulations."

In June 1980, the following regulations were made:

"PERMITTED ATTACHMENTS

3.- (1) Subject to section 4:

(a) a subscriber to a private line service leased from Sask Tel may connect any attachment to, and use any attachment in conjunction with, that private line;

(b) a subscriber to a particular telecommunication service from the public switched network of Sask Tel may connect to, and use in conjunction with, that service:

(i) general mobile telephone service stations;

(ii) computers and associated equipment connected to a telecommunication line of Sask Tel by means of an interface device supplied by Sask Tel;

(iii) where connected to a telecommunication line of Sask Tel acoustically inductively or by means of a coupler supplied by Sask Tel:

(A) automatic answering and recording machines;
(B) data sets;
(C) facsimile and telephoto equipment;

(D) teleprinters;
(E) cathode ray tube terminal equipment;
(F) telemetering equipment;
(G) non-network addressing alarm devices."

[(2) This subsection allows interim connection where an emergency arises.]

"CONDITIONS

4.- (1) Any attachment described in section 3 must:

(a) be designed, operated, used and maintained in such a manner that it does not:

(i) damage, interfere with or create a hazard to, or impair the functioning of, Sask Tel's service, equipment or channels; or

(ii) create a hazard or danger to the users of Sask Tel's service, equipment or channels, to Sask Tel's employees or customers or to the public; and

(b) be connected only at a point of connection designated by Sask Tel as being accessible to the customer.

(2) No attachment described in section 3:

(a) other than an attachment to a private line leased from Sask Tel, is to be used for the purpose of, or in any manner which accommodates the connection of the telecommunication lines or service of Sask Tel with the telecommunications

> facilities or service of another carrier or system; or
>
> (b) is to be mounted or installed inside Sask Tel equipment cabinets or housings.
>
> (3) Sask Tel does not guarantee or represent that its telecommunication lines or system are or will remain compatible with any attachment, and Sask Tel has the right to modify, substitute and change its telecommunication lines and system at any time."

[Other provisions cover trouble arising from customer-owned and maintained equipment. Costs of repair and maintance on such equipment are to be charged at custom work rates. Attachment under special agreement is also permitted.]

In Manitoba, *An Act to Amend The Telephone Act* was passed in 1977 but was never proclaimed. It was repealed in 1980 by *An Act to Amend The Public Utilities Board Act and The Manitoba Telephone Act,* known as Bill 107. The latter was adopted as Chapter 76, S.M. 1980, but it also has not been proclaimed.

The Public Utilities Board of Alberta, in an appendix to a recent telecommunications inquiry (Report No. E 80111), noted that main, premium and extension telephone sets, key telephones and associated equipment, private switchboards and associated equipment and the automatic dialing equipment in the category of basic telephone or basic (complementary) telephone service were "subject to possible revised policy on customer-owned terminal equipment." The CRTC's interim decision appears thus far to have gone further than those of other Canadian jurisdictions.

### b) Regulatory and Judicial History

Past terminal-attachment policies of telephone companies have been more restrictive than those now in effect. At one time, for example, even inert equipment could not be attached to Bell's telephones. During the late sixties, pressure developed in Canada for the attachment of customer-owned equipment. Mr. F.E. Ibey, Executive Vice-President - Operations, Bell Canada, indicated his belief that the pressure at that time would have been "more from potential suppliers and manufacturers than from customers, although there were some customers."

In February 1968, Mr. A.J. de Grandpré, then Vice-President, Law, of Bell Canada, appeared before the Standing Committee on Transport and Communications of the House of Commons to discuss amendments to *The Bell Canada Act*, one of which concerned the right to appeal Bell's foreign attachment requirements. He acknowledged the existence of the pressures to allow subscriber-provided equipment:

> "You hear some remarks to the effect that all the subscribers of the Telephone Company should be permitted to own their equipment, that they should be permitted to buy this equipment, and that there is no reason why it should be still under the control of the Telephone Company as it is today."

He indicated that Bell Canada was "prepared to admit that we should make our case in public for these requirements". He outlined the problems with subscriber-owned equipment, i.e., technical compatibility, the impact of subscriber-owned equipment on basic rates, and the issue of the possible influx of equipment of foreign manufacture. Mr. de Grandpré indicated that appeal of Bell's attachment requirements to the Canadian Transport Commission (CTC) would be appropriate and that that body should be staffed to deal with the various issues raised.

*The Bell Canada Act* was amended by Chap. 48 of the Statutes of 1967-68, subsections (4), (5) and (6) of section 5 of which allowed Bell's attachment requirements to be appealed to the CTC. These subsections read as follows:

> "(4) For the protection of the subscribers of the Company and of the public, any equipment, apparatus, line, circuit or device not provided by the company shall only be attached to, connected or interconnected with, or used in connection with the

> facilities of the Company in conformity with such reasonable requirements as may be prescribed by the Company.
>
> (5) The Canadian Transport Commission may determine, as questions of fact, whether or not any requirements prescribed by the Company under subsection (4) are reasonable and may disallow any such requirements as it considers unreasonable or contrary to the public interest and may require the company to substitute requirements satisfactory to the Canadian Transport Commission in lieu thereof or prescribe other requirements in lieu of any requirements so disallowed.
>
> (6) Any person who is affected by any requirements prescribed by the Company under subsection (4) of this section may apply to the Canadian Transport Commission to determine the reasonableness of such requirement having regard to the public interest and the effect such attachment, connection or interconnection is likely to have on the cost and value of the service to the subscribers.
>
> The decision of the Commission is subject to review and appeal pursuant to the *Railway Act*."

Later interpretation of section 5 by the regulator, CTC, was that it applied only in those cases where the company actually prescribed specific interconnect requirements.

Mr. J.M. Beddoes, a former official of Microsystems International Limited, stated that the 1968 *Carterfone* decision, which allowed customer-provided equipment in the United States, led him (at Microsystems) and Northern Electric to anticipate the possibility of this type of legislation in Canada.

In 1972 the Department of Communications (DOC) issued a Working Paper *(Working Paper on Possible Interconnection of Non-Carrier Owned Terminal Equipment and Terminal Systems to the Public Switched Networks)* which indicated that:

> "Recognizing their vulnerabilities as monopolies, the carriers have provided service beyond the limits outlined in the Act and in their rules."

Specifically mentioned was the fact that in 1969 the TCTS telephone companies liberalized their tariff restrictions to permit the attachment to the public switched network of any data communications device or alerting device activated by signals from the network if appropriate interface equipment were used. In the case of the former, Bell Canada from 1969 onwards provided data connector equipment for use with customer-provided data terminals. The proposed monthly rate for this equipment was four dollars and the proposed service charge, ten dollars (General Tariff Item 4240). Customer connection of data transmitting and receiving equipment to the public switched network prior to the introduction of this equipment could only be accomplished by means of a Data-Phone (data set) provided by Bell Canada.

Bell allowed some other types of equipment to be provided by customers and attached to its facilities through a coupler supplied by the company. For example, a coupler developed by Northern Telecom was used by Bell Canada to connect customer-provided answering and recording equipment and alarm systems. The 1974 tariff for recorder-coupler, alarm-coupler or voice-station-coupler equipment specified a monthly rate of $2.15 and a business service charge of $11.25. After 1976, some network non-addressing equipment could be certified under TAP.

There were various categories of equipment that Bell, like other telcos, insisted on providing itself. This did not go uncontested. The outright prohibition of a particular type of customer-supplied equipment, rather than an interface requirement, precipitated the actions before the regulator or courts cited below.

The Shulman Case* (re Dr. Morton Shulman, April 1975) was one of the first applications to the CTC pursuant to section 5 of *The Bell Canada Special Act*. Bell Canada disconnected the telephone service in Dr. Shulman's Ontario Legislature office because he refused to remove an automatic dialing device which he had purchased and attached to the telephone in his office. Arguing that he was adversely affected by the rule of the company prohibiting his connection and use of this device, Shulman applied to the Commission for an order directing Bell to allow him to connect his "Magicall" dialer to the company's facilities in his office. Bell Canada responded that since Bell had not established any requirements for the connection of this piece of customer-owned equipment to its telephone network, Shulman had no legal grounds on which to raise this matter under section 5 of *The Bell Canada Special Act*.

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* There were two previous attachment cases. The first was *Bell Canada v. United Sterl-A-Phone Corporation Ltd.* (1955) O.R. 1, where United had invented and

The CTC found that the company had not published any requirement for the connection to its facilities of a customer-owned "Magicall" dialer, and that consequently there was no requirement which the Commission could judge to be reasonable or otherwise. It stated that:

> "The Company's decision not to establish such requirement is, in our view, completely within the

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manufactured a device to be used with telephone receiving sets for the purpose of killing bacteria. The Court held that the attachment contravened both the agreement between Bell and subscribers and the Regulations pursuant to the *Railway Act*. The Court, however, rejected Bell's counterclaim and its claim for an Injunction enjoining the Plaintiff from offering to its customers any instrument or attachment which would be in conflict with the terms of Bell's contract with its customers. The next case was with Perception Industries, a company which installed its own internal telephone system within its offices. Bell terminated telephone service. The Supreme Court of Ontario ordered Bell to reconnect its external lines to the Plaintiff's internal telephone system. Following this order, the action was apparently dismissed and the equipment removed on consent.

> discretion of the Company under subsection (4) of section 5 of its Special Act."

The CTC accordingly found that it had no jurisdiction to grant the relief sought.

The "Magicall" dialer was repertory dialing equipment which stored on tape the telephone numbers to be dialed by the telephone subscriber, who could subsequently operate the equipment for automatic dialing. Bell Canada was providing the "Magicall" dialer as a standard service offering at the time.

Bell explained that it considered such terminal equipment to be an integral part of its public switched network, capable of controlling its central-office-addressing equipment, and took the position that the "Magicall" should be owned, installed and maintained by Bell.

Dr. Shulman argued that customer-owned alarm dialers, which Bell was not providing, could be attached to Bell facilities through a Bell-provided coupler, and that the company should permit the same type of connection to customer-provided "Magicall" devices.

The CTC found that it had been established that the two dialers were in fact very different instruments.

The Harding Cases - The Harding Corporation, an Ontario interconnect company and distributor of the "Magicall" dialer, had previously applied to the CTC under section 5 of *The Bell Canada Special Act* for permission to connect the "Magicall" automatic dialer to Bell Canada's facilities. A month after the Shulman decision, the CTC (in Telecommunication Committee Order No. T-658) dismissed Harding Corporation's application "for the same reason it dismissed the application of Dr. Morton Shulman, M.P.P., by Decision dated April 14, 1975, . . ."

On June 5, 1975, Harding applied to the Quebec Superior Court in Montreal for both permanent and interlocutory injunctions against Bell, enjoining Bell from interfering with Harding's business clients and from threatening to disconnect the telephone lines of Harding's clients. This action involved the "Divert-a-Call", a call-forwarding device described by the Superior Court as follows: ". . . when attached to a telephone set, automatically forwards, when required, a call received on this set, towards another". Harding had entered into negotiations with the Bank of Montreal, which was interested in using a "Divert-a-Call" system to divert telephone calls made after business hours to the Bank's credit verification office in Montreal to the Toronto office. The Bank had inquired as to whether or not Bell Canada could supply it with a "Divert-a-Call" system but had found Bell Canada's proposals to be "totally inadequate". The Bank informed Bell Canada that it wished to use Harding's "Divert-a-Call" and was prepared to lease couplers from Bell for interconnection purposes. The Bank asked Bell if it could supply the couplers and requested information on lead time. Bell's letter of response indicated that its policy did not permit the interconnection of Harding's "Divert-a-Call" unit to its network. The letter also indicated Bell's approximate leasing charges, "Should we [Bell] be able to purchase this equipment". After further negotiations, the Bank of Montreal accepted a system supplied by Bell Canada.

Following the above application for injunctions by Harding, Bell challenged the jurisdiction of the Quebec Superior Court, claiming that exclusive jurisdiction in respect of its obligations, if any, arising out of dealings between Harding and the Bank of Montreal, resided in the CTC. Judge Vallerand granted the request for an interlocutory injunction in a decision dated October 2, 1975.

In the matter of the interlocutory injunction, the Judge indicated that Harding and the Bank of Montreal had, in accordance with Bell's tariff, asked Bell to specify requirements and furnish connecting equipment and that Bell had arbitrarily refused to accede to this request. The remedy sought was granted, but the Judge noted that, if Bell specified requirements which the plaintiff and its clients neither accepted nor appealed to the CTC, Bell could again give notice of its intention to interrupt their telephone service.

Bell Canada appealed to the Quebec Court of Appeal, which affirmed the rulings of the Quebec Superior Court in March 1977. The Appeal Court indicated that in its opinion subsection 5(4) of *The Bell Canada Special Act*

> ". . . affirms the right of subscribers to attach all apparatus they wish to Bell's telephones: Bell's only right is to prescribe reasonable requirements which appear to it to be imperative 'for the protection of the subscribers of the Company and the public', which it has refused to do."

Bell then appealed to the Supreme Court of Canada, which ruled only on the issue of jurisdiction. Chief Justice Bora Laskin wrote the opinion of the Court *(The Bell Telephone Co. of Canada v. Harding Communications Ltd. et al.* [1979] 1 S.C.R. at 403), ruling that the Quebec Superior Court had the jurisdiction

> ". . . to decide whether s. 5(4) imposes a legal obligation upon Bell when the question arises in the course of judicial proceedings that are properly taken in that Court. That is this case."

The opinion of the CTC, in 1975, was that section 5 did not impose an obligation on Bell to specify attachment requirements. The Quebec courts were of a contrary opinion. One other case that involved section 5 was a CATV* case, and it will be referred to in more detail below. For the purposes at hand, it is sufficient to indicate that in *In re Ottawa Cablevision Ltd. et al. and Bell Canada,* [1973] CTC 522, the case before the CTC turned largely on the issue of whether the Commission could require Bell under subsection 5(4) to revise its agreements with the cable companies to permit them to attach their own transmission cables to poles or conduits owned by Bell. The CTC ruled that subsection 5(4) did not apply since the agreements did not involve attachments as contemplated in subsection 5(4). Leave to appeal was denied by the Federal Court of Appeal, [1974] 1 F.C. 373. In the words of Jackett C.J., this court was of the opinion that

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* Community-Antenna Television (CATV) Systems.

> ". . . there is no possible basis for reading section 5, or any part of it, as conferring on the Commission a jurisdiction to compel Bell to provide facilities that it refuses to provide or a jurisdiction to re-make contracts between Bell and its customers under which Bell is to provide facilities."

There have thus been several rulings on the meaning of subsection 5(4). The Supreme Court of Canada, in discussing jurisdiction in the Harding case, indicated that it would "finally settle any question of law raised by s. 5(4), whether it came through a Superior Court route or through a route leading from the Commission's decision."

Challenge Communications - The Challenge case was argued before the Canadian Radio-television and Telecommunications Commission (CRTC), which replaced the CTC as Bell's regulator in April 1976. The decision was made with reference to section 321 of the *Railway Act* rather than section 5 of *The Bell Canada Special Act*.

The Challenge case involved automatic mobile radio telephones. In September 1977, Challenge Communications Limited, a Toronto firm which sold mobile radio equipment to be owned and maintained by customers (referred to as customer-owned and maintained equipment (COAM)), applied to the CRTC for interim and permanent relief in the matter of a revised Bell tariff relating to mobile telephone service (MTS). The tariff, approved by the CRTC in July 1977, concerned the UHF (ultra high frequency) mobile radio system which Bell referred to as Automatic Mobile Telephone Service (AMTS). The equipment was automatic in that it could make and receive calls over the switched network without involving an operator when the vehicle was in its "home" area. Prior to this time, the system in use was "manual", requiring the assistance of a Bell operator to connect it to the main telephone network. Customer-provided equipment for use with the manual system had been allowed. Evidence at the CRTC hearing indicated, for example, that in July 1977, "there were 1,588 MTS users in Toronto-Hamilton, of which 1,264 were COAM".

When Bell applied for the AMTS tariff, it stated that it did not propose to provide for COAM units since the unit was network addressing. Once the tariff was approved, Challenge, which had been supplying MTS units, tried unsuccessfully to obtain equipment which would match the specification of the new AMTS units, called "Access 450" units. Motorola, the supplier of one of the parts, advised that it was unable to discuss any sales to Challenge because COAM units were excluded under the AMTS tariff.

Challenge then applied to the CRTC for interim relief under section 321 of the *Railway Act*, which prohibits discrimination. CRTC suspended the revised tariff pages and replaced them by those in effect prior to their approval, pending disposition of the application for permanent relief. Challenge made the application for permanent relief pursuant to section 321 of the *Railway Act* as well as to section 5(5) of *The Bell Canada Special Act*. The relevant provision of the *Railway Act* reads as follows:

> "321.(2) A company shall not, in respect of tolls or any services or facilities provided by the company as a telegraph or telephone company,
>
> (a) make any unjust discrimination against any person or company;
>
> (b) make or give any undue or unreasonable preference or advantage to or in favour of any particular person or company or any particular description of traffic, in any respect whatever; or
>
> (c) subject any particular person or company or any particular description of traffic to any undue or unreasonable prejudice or disadvantage, in any respect whatever;
>
> and where it is shown that the company makes any discrimination or gives any preference or advantage,

> the burden of proving that the discrimination is not unjust or that the preference is not undue or unreasonable lies upon the company."

The CRTC issued its decision in December 1977, after a public hearing (Telecom Decision CRTC 77-16). The Commission concluded that the revised tariff contravened section 321.(2) of the *Railway Act,* by discriminating unjustly against Challenge, and by subjecting Challenge to undue or unreasonable disadvantage. In reaching this decision, the Commission stated that section 321 is applicable to suppliers as well as to customers. The CRTC also ruled that Bell, when acting pursuant to Rules 7 and 9 of its General Regulations, must nevertheless comply with section 321 of the *Railway Act.*

The Commission did not make any finding pursuant to section 5 of *The Bell Canada Special Act.* It noted that several recent cases (Shulman, Ottawa Cablevision, Harding) had considered section 5 of *The Bell Canada Special Act* and that the Quebec Court of Appeal decision in the Harding case was then under appeal to the Supreme Court of Canada. The CRTC indicated that a ruling pursuant to section 5 was not necessary in the Challenge case, since it had been found that the failure to permit COAM equipment in AMTS in the present case was contrary to section 321.(2) of the *Railway Act.*

The Commission ordered that the tariff be revised with a COAM option. It also ordered Bell Canada to make available any necessary specifications, including those of its Access 450 equipment, in order that a COAM option be available to customers. The decision was appealed to the Federal Court of Appeal, which upheld the findings of the CRTC on the above-cited issues *(Bell Canada v. Challenge Communications Limited,* (1978) 86 D.L.R. (3d) 351). Leave to appeal to the Supreme Court of Canada was refused on June 19, 1978.

The Challenge case is important in that section 321 of the *Railway Act* was successfully invoked by a supplier to contest Bell's refusal to allow competing network-addressing equipment to be provided by customers and attached to its facilities.

## 2. Interconnection of Alternate Public Transmission Systems with Telco Facilities

The telephone company regulations which prohibit terminal attachment except in specified circumstances also prohibit the interconnection of telephone company facilities with alternate public or private transmission facilities. One effect of this is to limit the service which other public carriers can offer. Bell Canada's policies vis-à-vis three public carrier systems - the cable companies, CNCP and the radio common carriers (RCCs) - have been challenged. These carriers have gained more favourable access to Bell's facilities than previously prevailed.

### a) Cable Television Companies

Prior to 1976, under contracts with cable television licensees in Ontario and Quebec who wished access to Bell's support structures (poles and ducts) for their coaxial cable, Bell Canada retained ownership of the cable. These contracts also restricted the applications of the cable television systems. The effect of the latter was to reserve the provision of certain services to Bell Canada.

The most common arrangement between Bell and the cable licensees was the "partial system" agreement. Bell owned and leased the coaxial cable to the cable licensees, who owned the amplifiers, head-end and house drops. Approximately 80 per cent of the installed cost of the coaxial cable was paid by the licensee, who paid monthly rentals thereafter. The contracts generally had a duration of 10 years, at the end of which Bell retained ownership of the cable.

The cable operators wanted a "shared structure" (also called "pole attachment") arrangement. Thereby, the poles (or ducts) would commonly be rented from the telephone company by the cable company, which would own the entire cable facilities including the coaxial cable. Mr. O. Girard, President of Transvision Magog Inc., said that "the industry has been fighting since 1958 actually to reach the ultimate of obtaining complete ownership of our own plant." Mr. R.C. Chaston, President and General Manager of York Cablevision Limited, stated that this type of arrangement was not new, for many power companies had had, from the mid-fifties on, such agreements with the cable companies for the use of hydro poles. In 1978, there were arrangements permitting cable operators to own cable in British Columbia, Alberta and the Maritimes.

The partial system agreements placed various restrictions on the use of the coaxial cable by the customer (the cable operator). In the pre-1970 contracts, Bell required cable operators to use only part of the frequency spectrum (50 - 216 MHz). Point-to-point transmission was not allowed and limited transmission networks (signals to less than 100 per cent of the subscribers) were not permitted either. A new partial system contract was negotiated in 1970 in which the clause on the use of cable was modified. Restrictions remained, however: the use of the facilities was limited to the distribution of television and/or radio program signals. Inquiry-response type of communication was prohibited as was the use of devices capable of performing automatic- or manual-exchange switching.

Mr. Girard said that he still wanted a pole attachment arrangement so that he could add services such as surveillance, fire alarm, etc. The key issue was the provision of services that Bell maintained were its "domain", even though Bell was not providing these services at the time. Although *The Bell Canada Special Act* had been amended in 1968 to provide that Bell, or its subsidiaries, could not hold a broadcasting licence or a licence to operate a CATV service, the development of services which could be provided by either the cable companies or the telephone companies appeared to leave the law in a grey zone.

The *Railway Act* amendments that came into effect on August 1, 1970 brought the rates of private lines or facilities under the jurisdiction of the CTC. Bell filed tariffs with the CTC setting out charges applicable under its contracts with the cable licensees, but did not file the contracts as such for approval, maintaining they were not subject to regulatory jurisdiction.

The cable operators continued to pressure Bell for a shared structure (or pole attachment) arrangement. In 1972, a number of cable companies applied to the CTC to direct Bell to offer a pole attachment contract to the cable licensees. This followed an incident during which Bell cut a cable in a system operated by Transvision Magog Inc. when the latter refused Bell's offer to renew a partial system contract and was unable to reach agreement with Bell. The CTC decision dismissed the application on technical grounds. It held that section 5 of *The Bell Canada Special Act* (as amended in 1968) was not applicable, as:

> ". . . neither the present partial system agreement nor the proposed pole attachment agreement involve attachments to the Bell system of transmission contemplated in subsection (4) of section 5 of that Act."

Transvision Magog Inc. later applied under section 317 for "leave to carry certain cables of the Company across or near certain lines, wire, conductors and structures of Bell Canada . . .". In October 1975, the CTC granted the application and directed Bell to permit Transvision Magog Inc. to attach its cable to Bell poles at an annual rental to be agreed upon between the parties or to be referred to the Commission for decision. The CTC ruled that it could order certain works to be done and that Bell's ownership of its poles was subject to certain limitations.

Although Bell appealed this decision, in January 1976 it announced that it had changed its policy regarding pole attachment and had decided to adopt a "'shared access' policy permitting cable television operators to attach their own cables directly to Bell support structures". Bell also announced that it would not enter into any new partial system contracts.

In June 1976, Bell filed a tariff for its new offering with the CRTC. Following a public hearing, the CRTC found that:

> ". . . the Support Structure Offering substantially meets its concerns respecting the relationship between the cable and telephone industries and welcomes its introduction." (Telecom Decision CRTC 77-6)

The CRTC required Bell to continue offering its partial system arrangement, established rates for both offerings and determined that the agreements must be in a form approved by the Commission.

The parties were directed to negotiate new forms of agreement based upon the principles enunciated in the decision. At time of testimony before the RTPC in 1978, the issue outstanding in negotiations concerned the sale of facilities in converting to a shared structure agreement.

The CRTC insisted on the point that the principle of no restrictions on the services provided via coaxial cable applies to both the partial system arrangement and the support structure offering. The CRTC stated its view that copper-pair technology and coaxial cable technology were distinct transmission technologies providing distinct services. It nevertheless foresaw the development of new services that could be provided by either technology and felt that neither should be burdened with artificial barriers.

### b) CNCP

Both CNCP and TCTS offer national telecommunication services in Canada. Both built transcontinental microwave systems in the late 1950s and early 1960s, and provide competing services in the expanding specialized communications market. CNCP applied to the CRTC for certain interconnections with the Bell network in 1977. The decision dealt with many regulatory issues. The other members of TCTS, whose policies were similar to those of Bell, intervened in opposition to CNCP's application.

Some of the intervenors argued that the case should be decided with reference to section 321 of the *Railway Act* or the amended section 5 of *The Bell Canada Special Act*. The CRTC relied on sections 265 and 320 of the *Railway Act* which confer a specific authority on the Commission to make orders respecting the interconnection of systems and the exchange of traffic.

CNCP applied for two types of interconnection with Bell's facilities. Type 1 was the connection of CNCP's telecommunication system to the switching equipment in the central offices of Bell's public telephone system. This would allow CNCP to offer dial access to data networks and to and from private lines. Type 2 was the connection of the CNCP system to equipment which in turn was connected to such switching equipment or to a private line provided by Bell. This would enable CNCP to provide access to the same computers, concentrators, multiplexers and switches to which Bell facilities had access. Bell had specifically excluded the attachment of these types of equipment to its lines if they also were attached to those of CNCP.

The organizations intervening in support of the application included users, user organizations and data processing service bureaux. The parties in support of the application were the Director of Investigation and Research under the *Combines Investigation Act,* the Government of British Columbia and the Government of Ontario, the latter two giving partial support only. The Governments of Quebec and of all the Atlantic Provinces opposed the application, as did the other members of TCTS.

The test applied in assessing the application was a "public interest" test. This test was a broad one. In reaching its decision, CRTC examined questions of universality of service, consumer choice, quality of service, justness and reasonableness of subscriber rates (including rates to subscribers of connecting companies), the requirement that rates and conditions of service not confer an undue preference or disadvantage, innovation, efficiency of telecommunication systems, resource allocation, the structure of rates and industry structure.

CNCP argued that Bell had the statutory duty to provide facilities for the requested connections, that the development of CNCP services required and would increasingly require these connections and that lack of them restricted competition and threatened CNCP's viability. Denial of access between the local switched distribution system and the systems of CNCP was said to be an abuse of Bell's monopoly position. In testimony before the RTPC in October 1978, Mr. J.G. Sutherland, Vice-President, Telecommunications, Canadian Pacific Limited, stated that access to the switched distribution facilities of the telephone companies was essential in providing private line and computer communications, and that lack of interconnection hurt CNCP's competitive position in these services.

CNCP and various intervenors before the CRTC argued that the importance of Type 1 dial access was growing. Time-sharing applications and credit card verification were two uses cited. The desire for Type 2 interconnection was related to the growth of extensive private networks employing equipment such as multiplexers and concentrators. Type 2 connections would allow users to "mix and match" facilities and obtain reliable backup facilities at a lower total cost. The CRTC noted that more than 40 businesses and associations which submitted evidence either on their own behalf or on that of CNCP were "virtually unanimous . . . in their desire for interconnection which they regarded as a step towards increasing competition among such suppliers."

Bell submitted that the application was without foundation and was an attempt to obtain the use of Bell's local telephone facilities to capture a portion of long-distance revenues. Its main argument was addressed to the revenue impact of granting the application and the implications for rates and service. Bell estimated a 1982 revenue loss of $253.3 million if the application were granted, resulting in an increase of 27 per cent on basic residence, and 37 per cent on basic business rates. Bell stated that the revenues of all the telephone companies participating in long-distance service would be affected. Other telephone companies also argued that interconnection, by diverting traffic from TCTS to CNCP facilities, would diminish their long-distance revenues and harm their local subscribers.

Related to this was Bell's argument that the utility pricing principles which enable the provision of basic telephone service at as low a price as possible would be jeopardized if the application were granted. These principles involve subsidizing local rates with contributions from long-distance services, route-averaged pricing and avoidance of "cream-skimming". CNCP, however, maintained that local subscribers might benefit if the application were granted and implied that Bell was using revenues from its monopoly public telephone service to subsidize competitive services.

Witnesses for Bell also argued that sharing the local network with a competitor would adversely affect co-operation, network planning and the principle of end-to-end responsibility. Bell further stated that granting the application would allow CNCP to offer services that would undermine the economies of scale and scope, and technological change enjoyed by the Bell system.

The decision ordered Bell to provide Type 1 and Type 2 connections to CNCP, subject to restrictions to prevent the use of the connections to provide substitutes for Bell's MTS (message toll) and WATS (wide area telephone) services. The Commission agreed that Types 1 and 2 connections were useful and that lack of network access was an important factor in CNCP's declining market share. There could be no question of duplicating local facilities.

In response to Bell's principal argument, CRTC estimated the 1982 revenue loss to Bell attributable to granting the application to be $45.7 million rather than Bell's estimated $253.3 million. Much of this revision was due to the fact that Bell, in developing its estimate, had assumed that new message toll alternative (NMTA) services would be introduced by CNCP if the application were granted, with resulting revenue losses to Bell. The CRTC did not consider the provision of such services by CNCP to be within the scope of the application. Further CRTC took steps via restrictions to prevent the use of the connections to facilitate "public telephone service". The revenue impact of the application on subscribers of other telephone companies in Canada was found to be "negligible". To reduce the possibility of an adverse impact of the decision on Bell subscribers, the Commission ruled that CNCP would have to "bear its fair share of the costs of Bell's local exchange facilities." CRTC further concluded that granting the application would not result in any significant changes to utility pricing principles because competitive services already deviated from these, or in undue injury to or interference with the network. It also concluded that Bell had failed to support adequately its contentions regarding economies of scale.

Certain rate-making principles were discussed in the decision. The Commission accepted a "value of service" component for compensation for interconnection where this reflects broad user categories and not discrimination against a competitor or the subscribers of a competitor. This is a departure from cost-based pricing, but one that prevails throughout the industry rate structure. The loss of contribution towards the costs of facilities used in common due to the impact of interconnection on Bell's services was also deemed an acceptable component of compensation. The actual amount of contribution of various services to the cost of local exchange facilities was not clear, although the evidence indicated that the contribution level of MTS and WATS service to common costs (as defined by Bell) was greater than that of the competitive services.

The desire to guard against the erosion of MTS/WATS revenues and the desire to maintain the contribution from a route-averaged rate structure for MTS were explicitly referred to as considerations prompting the CRTC to impose restrictions protecting these services from direct competition. The CRTC was aware of the fact that the U.S. courts, overruling the FCC, had allowed carriers competing with AT&T to offer services which the FCC considered to be essentially MTS/WATS services. The FCC responded by opening a public inquiry to examine whether the public interest required that MTS/WATS be offered on a sole-source basis. This inquiry was just getting established at time of testimony before the RTPC in the course of 1979.

The development of microwave transmission had resulted in a series of FCC and court decisions which opened up competition in the domestic carrier industry in the U.S. In 1971 the FCC, citing a demand for a variety of specialized telecommunication services, decided upon a policy of open entry for specialized communications carriers (*Specialized Common Carrier Decision*, 29 FCC 2d 890 (1971)). A policy of multiple entry was adopted for domestic communications satellites one year later *(Domestic Communication Satellite Facilities,* 35 FCC 2d 844 (1972)). AT&T supplied some interconnections, but originally refused to furnish them for certain services. It was ordered to furnish interconnection facilities to other common carriers for all their authorized services *(Bell System Tariff Offerings,* 46 FCC 2d 413 (1974)). This principle was thus well established in the U.S. at the time of the CNCP decision.

### c) Radio Common Carriers

Both the radio common carriers and the telephone companies offer radio-paging services. Both are allocated frequencies pursuant to the provisions of the *Radio Act*. In 1978, three companies offering radio-paging services (Colins Incorporated, Pagette Airsignals Ltd. and TAS Communications Services) applied to the CRTC requesting orders requiring Bell Canada to supply "selector level" telephone numbers at fair and reasonable rates to them and any independent radio common carrier licensed under the *Radio Act*. The applicants filed an amended application requesting, in addition, orders requiring Bell to permit them to offer their customers access to paging devices outside local calling areas ("roaming") without payment of toll charges, on a basis similar to Bell Canada's offering in Ontario and its proposed offering in Quebec. Bell had introduced "roaming", sometimes known as "wide-area paging", in August 1977.

Radio-paging services permit one-way radio signaling to a portable pocket-size radio receiver or pager. Callers generally use the telephone network to gain access to the paging control terminal. The paging terminal is linked by various communication channels to radio transmitters which relay the signal to the pagers. In some cases the signal is a tone or a "beep"; in others, a brief voice message may also be transmitted. Bell Canada was offering one-way tone-only signaling (its Bellboy service). The applicants were offering one-way tone-only or one-way tone-and-voice service.

The interconnection issue involved the specific way in which the telephone network was used to gain access to the paging terminals. Control of Bell's system was centralized at two paging terminals - one in Toronto and one in Montreal - linked by Bell facilities to all the transmitters in a paging zone. Bell had four such zones. By utilizing the "outpulsing" capability of the DDD network, Bell used a paging number plan whereby the caller could signal a specific pager anywhere within one of Bell's four paging zones by dialing eight digits on the telephone. The roaming feature allowed pager signaling anywhere within the four zones at no additional charge.

To gain access to the applicants' paging terminals, the caller would dial a specific seven-digit number which provided "indirect access" to the terminal through a regular telephone business line. In many cases an operator relayed the tone or voice message to the pager via the paging terminal. Alternatively, "overdialing" or "end-to-end signaling" - described by the industry as being different methods which operate in approximately the same way - could be used. The caller, once connected to the paging terminal, could activate a signal which was transmitted to a pager by continuing to dial extra digits; but any connections routed through an electronic switch with a rotary dial would be disconnected if overdialing were attempted.

The applicants formally applied to the CRTC to obtain "selector level" telephone numbers and the roaming feature. They wanted seven-digit telephone numbers (NNX+XXXX) and outpulsing services for one-way tone-and-voice paging within an exchange's local calling area. They wanted eight-digit telephone numbers (1+55X+XXXX) and outpulsing services to their terminals and the member companies' terminals located in either Montreal or Toronto. After the main application was filed, Bell and the paging companies attempted to reach a negotiated agreement. This failed, for Bell agreed to supply the facilities and services requested only if conditions, which were objected to by the paging companies, were met. These conditions were that Bell's facilities be used exclusively to link the paging companies' paging terminals and transmitters where the terminal and transmitters were located in separate telephone local calling areas and that Bell's facilities be used exclusively to link paging company transmitters located in separate telephone local calling areas. Mr. T. Ryan, President, The Canadian Radio Common Carriers Association, said before the RTPC that these provisions meant that the RCCs would have to abandon their DOC licences and their own trunking facilities and agree not to deal with CNCP or any other carrier.

The applicants having applied for interim relief, CRTC stated that the denial of services and facilities that would permit the applicants to utilize outpulsing and offer roaming would in itself constitute a preference or advantage given by Bell in favour of itself within the meaning of subsection 321.(2) of the *Railway Act*. Furthermore, offering such services and facilities subject to the two conditions noted above would also constitute giving preference or advantage within the meaning of the Act. The Commission accordingly found that on a *prima facie* basis Bell had breached subsection 321.(2) of the *Railway Act*. It ordered Bell to cease any active solicitation of new subscribers to the service, including any further advertising. Although a hearing on the main application was to be held shortly, the CRTC suggested that a negotiated settlement would be preferable. No resolution was achieved prior to the public hearing in May 1979. However, an accord with specified interim rates had been reached at that time.

When Bell filed proposed final rates for access to Bell's switching equipment from the paging terminals of licensed radio common carriers in December 1979, Colins Incorporated, TAS Communications Services, Pagette Airsignals Ltd. and The Canadian Radio Common Carriers Association requested a public hearing. The Director of Investigation and Research under the *Combines Investigation Act* was an intervenor. All parties agreed in principle that the costs of providing the service should be recovered by Bell in its rates, but disagreed over specific costs and the various components that Bell had included in its proposals. The applicants and the Director argued that the costs charged the RCCs for outpulsing should be equal to the cost to Bell of providing that service to itself. Bell argued that the costs would be different since the network access arrangements for Bellboy were different from those for the RCCs.

The CRTC decided that it was not inappropriate for Bell to design a paging service different from others as long as the methodology used to determine network access costs was the same and provided Bell offered network access on fair and reasonable terms. The CRTC determined monthly rates for the local-paging seven-digit telephone numbers and the wide-area-paging eight-digit telephone numbers, and requested Bell to file distance-sensitive rates (including a charge for the dedicated central office equipment) for radio-paging trunk lines. Since the rates set for the RCCs included a contribution amount, CRTC ordered Bell to unbundle its Bellboy tariffs into network and pager rates to ensure that the network access component of the Bellboy service was making a contribution "at least equivalent" to that determined to be appropriate for the RCCs.

The CRTC heard testimony on the *Guard Band* decision in the U.S. *(Allocation of Frequencies in 150.8 - 162 Mc/s Band,* 12 FCC 2d, 841). This decision was also cited before the RTPC. In 1968, the FCC assigned previously unassigned spectrum for one-way services. The RCCs maintained that interconnection and toll-free services were two advantages enjoyed by the U.S. Bellboy service. In order to ensure competitive equality between the wireline (telephone) and the non-wireline common carriers (the RCCs), the FCC made the licences of the wireline companies subject to the requirement that they make facilities available to the RCCs under the same terms and conditions available to themselves. The charges to the RCCs for the facilities were to be identical with those costs used by the telephone companies in computing their own charges. As with CNCP, industry developments resulted in regulatory scrutiny of similar issues in both the U.S. and Canada. In both cases, these were dealt with somewhat earlier in the U.S.

Actually the complaints of Canadian radio-paging companies did not concern Bell only. Testimony before the RTPC indicates that B.C. Tel did not supply selector-level signaling to TASCO Telephone Answering Exchange Limited,* to

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* National Laser Products Limited of Richmond Hill, Ontario operates TASCO in Vancouver, Edmonton and Calgary. In Toronto and Montreal, its operation is

Wes-Tel Communications Ltd. nor to Distacom Communications Limited, even though B.C. Tel used seven-digit numbering for its own paging service. Interconnection was essential to the survival of independent radio-pagers, according to the testimony of Mr. H.C. Merry of Wes-Tel, given in June 1978 when he was President of CRCCA. Both Mr. H.M. Campbell, Vice-President and General Manager of National Laser Products Limited, and Mr. G.C. Reid of Allied Communications Limited stated that AGT and 'edmonton telephones' would not allow access to the selector or interconnection with the network. Mr. W.D. Messer of Distacom declared that plans to expand in Saskatchewan had to be abandoned because Sask Tel refused to allow any form of interconnection.

When NBTel applied to the New Brunswick Public Utilities Board for new rates for its "network extension services" in December 1978, CRCCA and Instant Communications Limited intervened because the application was silent with respect to the availability of these access and wide-area services to independent paging companies. Also it was not clear how paging was to be classified as a telephone service. Mr. T. Ryan, President of TAS Communication Systems Limited (which operated in Newfoundland, New Brunswick and Nova Scotia) and also President of CRCCA since the fall of 1978, declared that in Nova Scotia, MT&T offered selector-level signaling to independent radio carriers but at a completely unreasonable price.** Mr. K. MacInnis, appearing on behalf of CRCCA, Air-Page Communications Limited and Instant Communications Limited before the Board of Commissioners of Public Utilities in December 1978, claimed that MT&T wanted the

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called "Calling All People", "Appel A Tous". It also operates telephone answering services in Montreal, Toronto and Vancouver.

** Mr. Ryan had testified in June 1979 that neither Newfoundland Telephone nor Terra Nova Telecommunications Inc. offered paging services but notwithstanding he had not yet been successful in negotiating the provision of a seven-digit number for his paging service.

paging message declared "a telephone message . . . and thus an integral part of the telephone system", over which it has a monopoly, prior to the introduction of interconnection.

Subsequently, Air-Page Communications Limited, a company operating a paging service in the Halifax metropolitan area, applied to the Board of Commissioners of Public Utilities of Nova Scotia. Air-Page asked that it be declared to be a public utility and that MT&T be ordered to provide Air-Page with outpulsing service. In its decision dated May 11, 1981, the Board directed "that MT&T permit Air-Page's paging terminal to be connected with its network in Halifax in a manner that enables Air-Page customers to have direct dial paging before September 30, 1981; that MT&T apply to the Board before September 30, 1981, to set the rates to be charged to Air-Page for this service and the charges for the cost of interconnection provided by MT&T; and that MT&T shall not provide a direct dial voice paging service until the outpulsing service and numbers have been provided to Air-Page." MT&T has now appealed the Board's decision to the Supreme Court of Nova Scotia. This decision marks the first time that a provincial regulatory body has ordered interconnection of a radio common carrier system to a telco's network.

## 3. Federal Government Involvement

### a) Terminal Attachment Program (TAP)

A main area of federal government involvement with interconnection to date has been the development of TAP by the Department of Communications (DOC). TAP was introduced in April 1976. It provides for the attachment - without a coupler - of certified equipment to the facilities of the federally regulated telephone companies. It is applicable only to terminal devices (not systems) and to date only to certain categories of network non-addressing equipment. The program covers devices attached to the public switched telephone networks of Bell, B.C. Tel and CN, the private lines of all federally regulated carriers, the Broadband network of CNCP and the Multicom II network of Bell and B.C. Tel.

Because Bell's proposal to amend Rule 9 of its General Regulations specifies equipment certification by DOC as a necessary condition for the attachment of all customer-provided terminal apparatus, it is worthwhile to review the history of the existing certification program and some industry views of it.

The carriers participate voluntarily in TAP. DOC has indicated that in 1973, when it initiated discussions leading to the development of the program, the Telecommunications Committee of the CTC held the view that existing legislation did not empower the Committee to order the carriers to attach non-carrier-provided equipment to their networks. The Department, therefore, developed a co-operative program, "at least until such time as new telecommunications legislation was enacted which would enable the regulator to deal with the issue."*

Earlier studies prepared under the auspices of DOC had identified a desire for more liberal attachment practices. The majority of problems were said to arise with the attachment policies on the public switched network, not the private line services. A review of Canadian carriers' interconnection practices on the public switched network (Telecommission Studies, particularly Study 8(b)(iii), 1971) indicated that telco ownership and coupler requirements, while based on technical grounds, raised "economic issues which affect both the user and the manufacturer of terminals". The Study concluded that:

> ". . . there is substantial support for broadening interconnection practices for terminals. Changes must be undertaken, however, with the participation of users, carriers, and manufacturers, and could not be made until a number of issues related to interconnection have first been dealt with."

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* Written statement of Mr. A. Lapointe, Acting Deputy Minister, DOC, to RTPC, October 1977.

In an address to the Canadian Interconnection Forum in June 1975, a representative from DOC noted that "During 1971 it became apparent that the problem of the interconnection of foreign attachments was becoming sufficiently visible to warrant further Government exploration."

The Department requested briefs from interested parties which were used in preparing the *Working Paper on Possible Interconnection of Non-carrier Owned Terminal Equipment and Terminal Systems to the Public Switched Networks*, (1972).

This Working Paper was designed to stimulate comments from carriers, industry and users. Six policy options were outlined, ranging from maintaining the *status quo* to unrestricted *laissez-faire*. Concern for Canadian industry was expressed. Comments on the unrestricted *laissez-faire* option indicated that it would be of some concern that "in any deregulation strategy, associated steps be taken to assure Canadian industry an equal chance and that reciprocity develop in the case of foreign supply."

The Working Paper concluded that the Department did not possess sufficient evidence to suggest that wide-open interconnection was generally wanted or would produce significant benefits. Nevertheless, the evidence did indicate that a change in the existing situation was required, and that greater choice and innovation were desirable. The Paper stated that:

> "Everything points to the necessity of maintaining the integrity of the networks through proper standards and controls without the use of couplers."

The Paper noted that the carriers themselves had recently gone on record as not opposing in principle the liberalization of rules for the interconnection of terminal equipment, recommending "orderly, controlled liberalization".

The Terminal Attachment Program was a means of providing for this "orderly, controlled liberalization" of attachments. The federally regulated telephone companies, along with the provinces of British Columbia, Ontario, Quebec and Newfoundland, co-operated with the Department in its development. The terminal devices eligible for certification were - and still are - those network non-addressing devices which the carriers permit customers to provide. The carriers' tariffs allow the attachment without a coupler of such customer-provided terminal devices certified by DOC. Carriers are required to give notice of planned network changes, with a minimum advance notice of two years for major changes and six months for minor changes.

Although equipment certification under standards acceptable to the carriers meets Bell's concern with technical integrity, the program does not address a number of other issues raised by Bell. One of these - the impact of liberalized terminal attachment on the manufacturing sector - reportedly featured prominently in DOC deliberations. As stated by DOC's representative to the Canadian Interconnection Forum, this issue would "assume greater importance in any concept of attachment that is broader than the one I am talking about today".

Draft specificications for network interface were distributed to manufacturers, suppliers and various organizations prior to the issuance of final standards. In March 1976, the DOC issued certification standard CS-01 for single-line, network non-addressing, voice-terminal equipment such as automatic answering devices, dictation units and tape recorders. In May 1977, the Terminal Attachment Program Advisory Committee (TAPAC) was formed, adding representatives of manufacturers, suppliers, industry and users. With TAPAC's participation, a second standard - CS-02 - was issued in September 1978 for network non-addressing, single-line terminal data equipment such as modems and facsimile terminals.

Complaints have been voiced to the effect that TAP moved too slowly, was retrogressive in some respects and imposed overly onerous standards. For example, CICA (Canadian Industrial Communications Assembly) stated in an August 1977 letter to TAPAC that the exclusion of network addressing equipment resulted in a program that was "too shallow" and failed to meet the real requirements of users: alternative means of providing PBX and key system facilities. They argued that including data equipment under TAP would be a "retrograde step" because modems could already be connected to private wires and the special data networks without couplers or detailed specifications, and that the inclusion of acoustically coupled devices under Phase 1 of the program was a similar example, including equipment already in use without the program.

CICA preferred a program of attachment of certified addressing or non-addressing equipment to the public switched network and acceptance of the existing case for modems on private wires or specialized switched networks. The Canadian Business Equipment Manufacturers Association (CBEMA), appearing before the RTPC in December 1977, indicated the following drawbacks: carrier-supplied equipment is exempt from the certification process; the program is confined to network non-addressing products; it is voluntary on the part of the carriers, who determine the classes and types of equipment that are permitted to be attached; the technical specifications are in some cases more stringent than those required for network protection; it applies only to federally regulated carriers; the certification process is costly and time-consuming; Bell has insisted the program include certification for products to be attached to dedicated lines which, in CBEMA's view, would "increase the restrictions on attachment by establishing requirements where none exist today". Other evidence filed indicates that certain network non-addressing equipment for which there is some demand cannot yet be connected. Automatic call distributors are an example of this. The certification requirement for carrier-provided attachments reads as follows:

> "After commencement of the program, newly designed terminal equipment referred to in Section 3.4, and provided by the carrier in a tariffed service offering, will meet the requirements prescribed for certification. Should a carrier enter the competitive market and provide such equipment, the equipment must be certified."

Testing by DOC therefore applies, but only if Bell sells competitively, i.e., on an unregulated basis.

In April 1979, members of TAPAC decided that technical standards for network addressing devices should be developed even though none of the carriers involved had yet amended their tariffs to permit the attachment of such devices. Since TAP is a voluntary program, there is no apparent legal obligation for carriers to file tariffs for devices that they do not want attached to their networks. When asked if Bell had the right to refuse to file a tariff for equipment that had been certified by the DOC, Mr. F.E. Ibey, Executive Vice-President, Operations, of Bell Canada, responded: "That's a hypothetical question . . . I see no reason why we would refuse to file it." He further indicated that disputes were "part of the process", and that "it is a basic understanding that if it is approved, we will connect it . . . There may be, but I don't know if there is any legal obligation."

Bell applied to its regulator in November 1979 for a decision as to whether liberalized attachment is in the public interest. If the CRTC decides affirmatively, Bell has proposed DOC certification as a condition for allowing customer-provided equipment to be attached to its facilities. A problem remains nevertheless. Bell is a major participant in the DOC certification process. There is no guarantee that certification standards acceptable to the industry in general (and to DOC) will be developed for all the items of equipment that manufacturers, suppliers or users might wish to introduce.

### b) Proposals for a Telecommunication Policy

At the same time that the Department of Communications designed TAP to work within a framework of carrier discretion, the Department outlined legislative proposals which explicitly transferred that discretion to a regulatory body, subject to direction from the Governor in Council. Several papers issued by the Department outlined the concerns and intentions of the federal government. *Proposals for a Communications Policy for Canada, a Position Paper of the Government of Canada* was issued in March 1973 and was intended as a basis for discussion with the provinces, industry and others. *Computer/Communications Policy, a Position Statement by the Government of Canada* was published in

April 1973 and was similarly presented as a basis for discussion. *Communications: Some Federal Proposals* (hereinafter referred to as the Grey Paper) was issued in April 1975. The latter set out the intentions of the federal government, taking account of views expressed by the provinces, as a basis for further consultation and an early revision of federal communications legislation. The government intended to formulate a telecommunication policy which would ensure that stated national objectives would be met. These objectives were to be similar in scope to those already established for broadcasting and were to be incorporated in a statute.

Developments relating to cable, satellites and the transmission of data formed the background to this initiative. Cable technology, satellite technology and the integration of the technology of computers and communications resulted in a vast expansion in the means of information transfer, which the government felt had potentially profound effects. Also, formerly distinct systems of electronic communications were more "interconnected, more integrated, and more powerful".

One might have added that they were also more competitive. Coaxial cable, microwave, satellite systems, and future technologies of even broader potential could all carry conversations, messages, data and broadcast programs. Cable television systems had the potential to provide two-way services involving direct exchanges between the public and broadcasters, as well as access to computers, databanks and other sources of information and entertainment. The fact that the services can and generally do extend beyond provincial limits imparted a national dimension to telecommunications, making common objectives and co-operation important.

The government felt that even within the sphere of federal jurisdiction, existing legislation had to some extent been overtaken by the advance of technology. The powers of the federal regulatory body, the Canadian Transport Commission (CTC), were not related to any statutory national policy and objectives. It "does not have, or has not in the past exercised, authority over a number of matters . . .".

The new legislation would provide a frame of reference for the federal regulatory body and empower the government to give formal directions on the interpretation of statutory objectives and the means for their implementation. The government proposed a single federal agency for telecommunications, including broadcasting. The regulatory link between transportation and communications was no longer of special importance, having been replaced by the increasing interaction between cable television and telecommunications.

Within the limits of federal jurisdiction, the new Commission would be empowered to order the attachment of apparatus or equipment, subject to appropriate conditions, after determining whether or not this was in the public interest. It was also to be empowered to make decisions as to whether, and on what conditions, interconnection of private systems with the public switched network would be allowed. In addition, the Commission was to be empowered to approve all agreements between federally regulated carriers and CATV operators covering the use of facilities, and to order the carriers to furnish access at reasonable rates and without unreasonably restrictive conditions. Provincial concern regarding the interconnection of public carrier systems was noted. Arrangements were proposed for more effective collaboration between the federal and provincial governments and regulatory bodies. Jurisdiction is, of course, divided in the case of the telecommunication carriers. This division, which left the recognition of a "national dimension" in the networks as a whole largely to the discretion of the Trans-Canada Telephone System (TCTS), was felt to impede the achievement of national objectives. The provinces were particularly concerned with developments in cablevision and interconnection. The Grey Paper suggested that their views be applied to the decisions of the Commission through the directions of the Governor in Council. The Grey Paper also proposed that the federal government seek the concurrence of each provincial government in the nomination of one of 10 part-time members to be appointed for a term to the Commission.

The government was to revise existing federal legislation in two stages. In the first stage, a single regulatory body would be established to exercise the powers and functions of the Canadian Radio-Television Commission and the Telecommunications Committee of the CTC. No provision was seen at that stage for any change in the powers to be exercised under the existing statutes. The second stage legislation would be more comprehensive.

The first stage of the proposed legislation was enacted in 1975 (23-24 Elizabeth II, C. 49) and the newly formed Canadian Radio-television and Telecommunications Commission was established on April 1, 1976. Bill C-16, the most recent version of a proposed Telecommunications Act, addressed several of the Stage II proposals. The Bill outlined telecommunications policy for Canada. The regulation of telecommunications in Canada was to be "flexible and readily adaptable to cultural, social and economic change and to scientific and technological advances . . .". The Bill would empower the Minister of Communications to issue performance objectives for telecommunication facilities and services other than broadcasting services. In addition to the power to review, set aside, refer back or (except for decisions made under Part III (broadcasting)) vary a decision of the regulatory body, the Governor in Council would, with specific restrictions, be empowered to issue directives to the Commission respecting the implementation of the telecommunication policy for Canada enunciated in the Act. Various provisions for federal-provincial co-operation were incorporated.

The Bill explicitly empowered the Commission to direct carriers to provide access to and use of facilities and services, including interconnection, under such terms and conditions as it might determine. The interconnection of carrier facilities with each other was contemplated and paragraph 27(1)(c) directed the Commission to hold public hearings in this type of case.

Bill C-16 died on the Order Paper when Parliament was dissolved before the 1979 election. The government's concern with communications is, of course, a continuing one. The issues raised by divided jurisdiction have yet to be resolved. The CRTC, however, has responded to many of the interconnection issues by resorting to existing legislation.

## 4. Telecom Decision CRTC 80-13: Bell Canada - Interim Requirements Regarding the Attachment of Subscriber-Provided Terminal Equipment

On November 13, 1979, Bell Canada applied to the CRTC for an order approving an amendment to Rule 9 of its General Regulations. Bell proposed to designate the existing rule as 9(a) and to add a clause (b) as follows:

> "(b) In any case where terminal equipment, terminal apparatus, or a terminal device not provided by the Company is approved or certified by the Department of Communications of the Government of Canada and bears an identification mark specified by that Department that indicates compliance with standards which have been specified by the Company and approved by that Department, and written notice of such certification, together with an adequate written description of such equipment, apparatus or device has been given to the Company, the Company shall prepare and file tariffs in respect of the connection, attachment or use of such equipment, apparatus or device in connection with the facilities of the Company, and upon approval by the Canadian Radio-television and Telecommunications Commission of such tariffs, shall permit the connection with the facilities of the Company of such certified equipment, apparatus or device, the whole subject to such terms and conditions as are set out in the applicable tariffs of the Company."

Rule 9(b) establishes a process wherein Bell Canada, subject to DOC and CRTC approvals, would specify technical standards and conditions for permissible attachment. No deadline for the development of the standards was indicated although Bell noted in its application that the subject was already under consideration by TAPAC.

Bell specified that the application was intended to bring before the Commission the question of the liberalization of the rules regarding the connection of terminal devices, particularly network addressing terminal devices, "in order to have the Commission and the public seized with the very real questions which such liberalization will raise, and in order to have the Commission determine whether such liberalization is in the public interest," and should be allowed.

The application listed some of the factors that in Bell's view required consideration before a decision could be reached on the question of the desirability of more liberal attachment policies. Most of these were elaborate issues and Bell has maintained for many years that they required resolution: network protection, the concept of basic service, the impact of liberalized attachment on Bell's operations, the implications for the Canadian manufacturing industry and Bell's competitive position. If CRTC decided that liberalized attachment requirements were in the public interest, Bell wished the Commission to declare that the requirements set out in amended Rule 9 were "reasonable".

Bell did not anticipate an early final decision on its interim requirements for interconnection that accompanied its application. Telecom Decision CRTC 80-13 disallowed Bell's proposed interim requirements and prescribed others in lieu thereof. The CRTC's order does not address the broader questions raised by Bell Canada in its application. A public hearing to consider the main application is contemplated for the last part of 1981. In the interim, CRTC has ruled that a sufficient condition for the attachment of terminal equipment to Bell Canada's facilities is that it meet the standards of the U.S. Federal Communications Commission.*

Under Bell's proposed interim requirements, users would have had to enter into a special agreement with the Company. The latter indicated that it considered its pending application (of November 13, 1979) to be reasonable cause for refusing to sign a special agreement for connection of subscriber-provided equipment except in exceptional circumstances. Even in these circumstances it would require that any such device satisfy Bell's technical standards. The Commission stated that the pending application did not constitute reasonable cause for refusing to sign a special agreement, and disallowed the proposed requirements. Various parties suggested that one purpose of the interim requirements should be to provide relief to customers seeking to attach their equipment to Bell's facilities during the interim period. Many made arguments that questioned the lawfulness of Rule 9, having regard to section 321 of the *Railway Act*. The Commission decided that in the light of Bell's interpretation of the interim requirements there was "too great a likelihood that the Company would exercise its discretion pursuant to Rule 9 in such a way as to give rise to breaches of section 321."

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* The Tariffs and General Regulations of the Company, including Rules 7 and 9, are to remain in effect, but only to the extent that they are not inconsistent with the interim requirements.

The CRTC prescribed interim requirements for terminal equipment and defined such equipment as follows:

> "'subscriber-provided terminal equipment' means, with the exception of the inside wiring and telephone set included in the provision of primary residence or business exchange service, any network addressing terminal equipment not provided by Bell Canada which is intended for use in conjunction with individual or trunk line primary exchange service;
>
> 'terminal equipment' means any equipment, apparatus, line, circuit, or device not directly or indirectly attached to the facilities of any other telecommunications carrier or communications system except as permitted by Bell Canada's tariffs;"

Terminal equipment which meets at least one of the following technical requirements may be attached:

(a) the equipment is of a class and manufacture which meets the requirements of Bell Canada document TCS-130;

(b) is of the same class and manufacture as that provided by Bell to its subscribers; or

(c) is of a class and manufacture which meets the current requirements of Part 68 of the Rules and Regulations of the Federal Communications Commission of the United States.

Bell has consistently stated to the RTPC that FCC standards are inadequate, arguing that they do not prevent degradation of service to second and third parties. In its arguments before CRTC, Bell objected to the adoption of American standards, indicating that this would undermine the work of the Terminal Attachment Program Advisory Committee (TAPAC) in developing Canadian standards, and would disregard the provision of subsection 5(4) of *The Bell Canada Special Act* that interconnection requirements afford protection to Bell's subscribers and the public.

The CRTC found that the technical standards submitted by Bell (TCS-130) would, by themselves, unduly limit the equipment which could be attached during the interim. It anticipated that TAPAC would develop Canadian standards that could be considered appropriate for terminal attachment. It considered that FCC standards would be adequate in the interim.

The interim requirements do not preclude the negotiated purchase from Bell Canada of any inside wiring that can be re-used when installing a key system or PBX provided by a subscriber. Several parties raised the issue of the connection point between Bell's facilities and the subscriber's terminal equipment. Bell and the subscribers are to come to a mutual agreement on the interface point and a jack and plug arrangement is to connect all categories of terminal equipment. Such arrangement would provide a clear demarcation point between Bell's network and the subscriber-provided equipment and facilitate fault location. Any attachment is subject to the final decision on Bell's application. Certain attachments made during the interim period, however, can continue if circumstances so warrant, even if they are not allowed by the final decision.

Since the question of "unbundling" - allowing separate charges for access, terminal equipment and inside wiring - will not be considered until the main application is dealt with, the inside wiring and telephone set provided as part of the basic residence and business exchange service are not now permitted to be provided by the subscriber. Extension sets can be, however. Bell was not allowed to levy a charge where extension sets were provided by the customer and has therefore proposed a wiring/access charge to apply during the interim period to all single-line extension telephones provided by customers. The actual discount from the charge for the extension supplied by Bell would be $0.55.

On August 18, 1980, The Honourable J. Snow, Minister of Transportation and Communications for Ontario, addressed a Petition to the Governor in Council under section 64(1) of the *National Transportation Act* to vary Telecom Decision CRTC 80-13 to provide that the interconnection equipment market in Canada be open only to exporters from countries that grant reciprocal treatment to Canadian exporters.

Mr. D. Vaugeois, Minister of Communications for Quebec, in a press release entitled "Minister Vaugeois Denounces CRTC Interference", dated August 12, 1980, had already expressed the Quebec Government's grave dissatisfaction with the interim decision.

Bell Canada followed with its own Petition to the Governor in Council, on September 26, 1980. Bell Canada noted that in its application of November 1979 to CRTC, it had raised the following public interest issues:

> "a) The need to protect the quality of service and the integrity of Bell Canada's network, with all that such need implies;
>
> b) The need for Bell to retain the ability to plan and coordinate technological change to provide for network improvement;
>
> c) The question of the impact of liberalization on the Company's business and revenues, which impact would inevitably affect the cost of service to subscribers;

d) The implications of liberalization for the Canadian telecommunications manufacturing industry, a matter which will be discussed further below;

e) The need to ensure that Bell Canada would be placed in a position where it could compete fairly with other suppliers of terminal equipment."

The interim decision gave consideration to the first two only of the above public interest issues. In particular, the interim decision did not consider the effect of the decision on Canadian manufacturers of telecommunication equipment.

In a Joint Statement by The Honourable F. Fox, Minister of Communications, and The Honourable H. Gray, Minister of Industry, Trade and Commerce, issued on May 7, 1981, the decision of the Governor in Council was announced. It was to the effect that Telecom Decision CRTC 80-13 would not be varied or rescinded. In arriving at this decision, the Governor in Council gave consideration to the two main concerns expressed by parties petitioning or commenting on the CRTC decision:

"1) the technical standards which should apply to the equipment to be connected; and

2) the impact of the CRTC decision on Canadian industry and trade."

With respect to the first concern, the Joint Statement declares:

> "The development of suitable standards for Canada is being achieved within the framework of the Terminal Attachment Program Advisory Committee (TAPAC). This is a voluntary organization, chaired by the Department of Communications, whose membership includes major Canadian telecommunications carriers, manufacturers, participating provincial governments and users. TAPAC has been actively engaged in

> developing standards for the three types of equipment contemplated by the CRTC decision: single line telephones, multiline telephones and private branch exchanges (PBXs or switchboards). The standards for single line telephones were published in the Canada Gazette on January 31, 1981, the multiline telephone standards were gazetted on April 11, and the PBX standards are expected to be gazetted shortly. Following publication in the Canada Gazette, sixty days are allowed for public comment."

With respect to the second area of concern, the Joint Statement explains that:

> ". . . the Department of Industry, Trade and Commerce, in consultation with the Department of Communications, will undertake discussions with foreign governments with a view to opening up international markets for Canadian terminal equipment, particularly in Europe and Japan. Finally, the CRTC has announced that the impact of liberalized terminal attachment on the Canadian telecommunications manufacturing sector would be one of the subject areas that would be considered in its fall hearing."

# CHAPTER VI

# TERMINAL ATTACHMENT - OTHER COUNTRIES

The terminal attachment policies of other countries influence Canadian attitudes and opportunities. While U.S. attachment policies are now quite liberal, those elsewhere remain restrictive.

## 1. U.S. Experience

### a) Judicial and Regulatory Policy

As was the case in Canada, at one time even inert, customer-provided equipment could not be attached to the U.S. telephone network. Prior to the *Hush-A-Phone* decision in 1956 (238 F. 2d 266 (1956)), attachment of user-provided equipment to the telephone network was barred, except for the exemption by telephone companies of certain equipment connected to private-line or dedicated-transmission facilities. In *Hush-A-Phone v. The United States,* the Federal Circuit Court of Appeals for the District of Columbia ruled that the Bell System's tariff restrictions prohibiting the attachment of customer owned devices were an "unwarranted interference with the telephone subscriber's right reasonably to use his telephone in ways which are privately beneficial without being publicly detrimental". The Hush-A-Phone was a plastic cup attached to the telephone instrument to filter out noise in the environment of the caller. AT&T's 1957 tariff revisions, consequent on this decision, permitted the attachment of devices external to the telephone instrument but did not allow acoustical or direct electrical connections to the telecommunication network.

The Federal Communications Commission's *Carterfone* decision (13 FCC 2d 420 (1968)) broke through federal and state tariff barriers to interconnection and permitted the growth of the interconnect industry in the United States. A Carterfone was an acoustical coupling device used to interconnect the base station of a mobile radio system with the public telephone network.* AT&T claimed that the Carterfones were prohibited by the tariffs. Relying on the argument that a tariff regulation which prohibits all devices without discriminating between the harmful and the harmless goes beyond what is reasonably required for the protection of the telephone company's operations or the system's utility to others and encroaches upon the right of the user to make reasonable use of the facilities, the FCC held that the AT&T tariff not allowing the Carterfone was "unreasonable and unlawful" and made it clear that this policy was to apply to other interconnection devices.

The possibility of a conflict between federal and state law was raised when, in 1973, several states introduced regulatory proceedings to ban the interconnection of customer-provided equipment to the intrastate facilities of the telephone network. In the case of *Telerent Leasing Corp.* (45 FCC 2d 204 (1974)), the FCC declared the pre-emptive character of its *Carterfone* decision. This was affirmed by the Fourth Circuit Court of Appeals. Thus, states could not, through their intrastate tariff system, interfere with users' rights to interconnect their own equipment to the interstate telephone network.

AT&T's response to *Carterfone* was to allow the electrical connection of any type of voice or data equipment through a carrier-provided connecting arrangement. The language of the *Carterfone* decision was, however, somewhat ambiguous, and there was some uncertainty regarding the interconnection of electrically connected equipment such as PBX and key apparatus which could be substituted for carrier equipment. In 1975, AT&T filed an exception to its interstate connecting arrangement tariff prohibiting customer substitution of PBX and key apparatus within the area of one of its operating telcos. The FCC rejected the argument that

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* In Canada the non-telco-operated mobile telephone systems are not interconnected to the public telephone network.

*Carterfone* never intended the substitution of customer-provided for carrier-provided PBX and key equipment. A court challenge of this decision failed.

During these years, tariffs for TWX and telex services also were revised to allow customer-provided terminal attachments. Mr. E.H. Cole, Assistant Vice-President of Business Development for The Western Union Telegraph Company, stated before the RTPC that Western Union, in the course of the FCC hearing on its proposed acquisition of TWX, entered a statement of principles which included permitting customer-provided terminals on the TWX network. Tariffs to that effect were introduced for TWX in 1972, and, he believed, for telex at the same time. Mr. Cole asserted that Western Union, as part of its TWX acquisition agreement with AT&T, had to supply a protective coupling device rented from the telephone company to the terminals attached to the TWX network. He added that this specific type of device was not required on the telex network.

b) Technical Harm

The alleged purpose of the carrier-provided connecting arrangement was the protection of the nation's telephone network from technical harm. Mr. E.B. Spievack, General Counsel for the North American Telephone Association (NATA), a national trade organization made up of manufacturers and distributors of competitively supplied telephone terminal equipment and systems, commented on the economic impact of this requirement on competing suppliers:

> ". . . the connecting arrangement requirement constituted a substantial economic barrier to the growth of interconnect industry sales volume. It set an upper limit to prices interconnect vendors could offer, since monthly lease rates, when added to connecting arrangement charges, had to remain price competitive in comparison to carrier rates for interchangeable equipment. Depending on rate variations related to the jurisdictional situs of different carrier operations, connecting arrangement charges could add up to 20 per cent to the cost of customer equipment over the term of an interconnect lease."

In recognition of the fact that the post-Carterfone tariffs imposed restrictions on customers and independent suppliers of terminal equipment, the FCC instituted Docket 19528 to determine whether liberalization of the tariff requirements was in the public interest. The FCC noted that many "special" entities (e.g., gas, oil, electric, and transportation companies, selected industrial firms, the Department of Defense, NASA and customers in "hazardous or inaccessible locations") "have long been and continue to be allowed to connect their equipment and facilities directly to the telephone network by means less restrictive than carrier-provided connecting arrangements . . . apparently without causing harm to the network." The FCC added that no harm had been demonstrated as a result of the interconnection of some 1600 local telephone companies to the Bell System, although many of the companies "purchase and connect without benefit of carrier-supplied connecting arrangements the identical independently manufactured terminal equipment for which the individual user must lease carrier-supplied connecting arrangements." The Commission concluded that the tariffs were "unnecessarily restrictive" and that they constituted "unjust and unreasonable discrimination" among users (or classes of users) and among suppliers of terminal equipment. An FCC equipment registration program was adopted instead. The first orders, issued in November 1975, covered data and ancillary equipment. Similar orders were issued for PBX and standard and key telephones in March 1976. These decisions were appealed to the Fourth Circuit Court of Appeals, which reaffirmed the FCC's paramount authority over terminal equipment and facilities used jointly for intrastate and interstate communications.

The orders in Docket 19528 required the registration of carrier-supplied as well as independently supplied terminal equipment. This requirement was to be reviewed within one year. At the time of testimony (January 1978) it appears still to have been required. Dr. M.R. Irwin, Professor of Economics at The Whittemore School of Business and Economics of the University of New Hampshire, testified before the RTPC that "the Commission adopted AT&T's recommended standards, but relaxed them when Bell insisted its own equipment fell short of such standards."

The Commission completed its rules on the registration program covering PBX and KTS equipment on April 13, 1978. In June, Commission staff completed a "grandfather" list which included equipment connected directly to the network by carriers prior to October 17, 1977. Mr. Spievack stated that the "grandfather" clause permitted new installations of such equipment up to the "registration only" date. (This date was June 1979 at the time of the testimony.) He said that equipment sold to the interconnect industry prior to October 1977 was also sold to carriers and that "practically everything" was grandfathered in, the only exception he knew of being the products of one manufacturer.

Mr. Spievack stated that, in addition to the FCC Docket, regulatory proceedings in New York, North Carolina and California found that the interconnection of customer-provided equipment produces "no numerical incidence of trouble greater than the reports of trouble associated with carrier-connected equipment". An FCC report issued in January 1980, however, noted that Bell had filed trouble report rates for private-line service of 16.1 per month per 100 circuit terminations for customer-provided equipment versus 9.0 for carrier-provided equipment. The equivalent rates for message telephone service showed customer-provided equipment having a higher, but not greatly higher, rate than Bell equipment - 7.86 versus 6.86 per month per 100 lines. More instances of the source of trouble not being found were reported for customer-provided equipment - 2.57 versus 1.97 per month per 100 lines. The cost of service was being borne by the telephone companies. The FCC concluded that "this is apparently a tariff problem, but it is possible that some technique or device may be required to isolate efficiently the line trouble from the equipment trouble."

### c) Economic Harm

As in Canada, the issue of the contribution of terminal equipment to local exchange services was raised. The telcos argued that business vertical services such as PBX, KTS, and centrex, subsidized residential customers, keeping basic exchange rates down. They argued that other kinds of terminal equipment, e.g., business or residential extensions, also provided such contributions.

The FCC opened Docket 20003 to examine this issue. The effect on both the "direct" and "indirect" contributions was studied. The direct contribution is that made to local exchange services if the terminal equipment services are priced above their associated costs. The indirect contribution is related to the separations and settlement procedures used by telcos in the United States to allocate costs and revenues between the interstate and intrastate services. These services fall under different jurisdictions with different operating organizations responsible for long-haul transmission and local exchanges.

Two reports were issued in Docket 20003. The FCC concluded that neither the amount nor the existence of claimed direct contribution by terminal equipment had been shown by the telephone industry's contribution studies. On the basis of studies in New York, Massachusetts, Vermont and Kansas, and its own examination of telephone industry data submitted, the Commission found it likely that business vertical services (PBX, KTS and centrex) as a group were the recipients of subsidy. The Commission also argued that measures of contribution loss were based on over-estimates of interconnect market penetration. The FCC did find, however, that terminal equipment competition could affect the distribution of revenues from the interstate pool and recommended consideration of changes in the separations procedure to protect marginal, independent telephone companies.

A Stanford Research Institute (SRI) study of the First Report in this Docket, conducted for AT&T, was entered as evidence before the RTPC. Conclusions reached regarding cross-subsidies are sensitive to the cost methodology employed. SRI criticized the FCC's concept of contribution for being based on fully distributed and retrospective (historical) costs rather than on long-run incremental (prospective) costs. SRI criticized the treatment of revenues also, claiming that it was assumed that each customer lost made a revenue contribution equal to the average of all contributions, whereas the possibility for "cream-skimming" (alleged by Bell to have occurred in the terminal equipment market) may have meant that the customers won by the interconnect companies yielded a net return higher than the average.

In its Second Report in Docket 20003, the FCC reported findings in New York State which indicated that terminal equipment was being supplied by the telco below cost. They also indicated that interconnection was causing contribution losses; interconnect competitors in that State were apparently penetrating the more profitable market sectors. The FCC nevertheless noted that the two New York studies taken together indicated that, if competitors caused the removal of all company-supplied terminal equipment, there would be a decrease in the general revenue requirements.

Another issue that arises in assessing the extent of "contribution" is the degree to which joint and common costs can be (and are) separated. Both the FCC and SRI criticized AT&T's contribution estimates for being based upon a cost concept which involved the non-allocation of joint and common costs identified as 43 per cent of total costs. Market penetration estimates are also debated. It is therefore not surprising that SRI, although concluding that present and future contribution losses are likely, found that docket material did not provide supportable quantitative estimates of the former, and that the magnitude of the latter was uncertain.

Finally, a question which was not answered in the evidence presented before the RTPC is whether business vertical services were providing a net return prior to *Carterfone*, which was then eroded when some of the AT&T operating companies responded to interconnect competition. Of interest here is Bell's submission to Docket 20003 that one reason for contribution losses was the fact that some terminal equipment rates had to be lowered to meet the competition. A study by T&E, a consulting firm that worked on Docket 20003 for the FCC, elaborated a variety of pricing techniques used by the Bell System in several jurisdictions to compete in price: e.g., two-tier pricing,* price hold-downs, a movement from a "value"- to a "cost"-of-service approach. (Part 1 - Deliverable F, Bell System Pricing

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* "Two-tier pricing" is discussed in Chapter VII.

Practices in the Competitive Terminal Equipment Field as Illustrated by State Regulatory Proceedings.)

### d) Ensuring a Competitive Environment

Since the Reports in Docket 20003 argued that there was evidence that terminal equipment services were being subsidized, it is not surprising to find the telephone companies accused of "predatory" pricing. Mr. Spievack testified that vertical integration combined with cross-subsidies from general ratepayers to terminal equipment services results in predatory pricing. He stated that the "underpricing scheme" is orchestrated at "both the manufacturing and distribution levels of operation", and that:

> "Through the manipulation of product line groupings, Western Electric prices key systems at approximately 16 per cent below cost, and PBX equipment at about 39 per cent below cost. Under the rubric of long-run incremental cost and incremental market analysis, Bell System operating companies are able to reduce key system and PBX equipment rates anywhere from 25 per cent to 70 per cent below actual distribution, installation and carrying costs. The various methodologies employed have the effect of leaving non-revenue producing investments on the carrier's books of accounts, and produce enormous internal pressures for cross-subsidies and for higher rates generally."

Mr. Spievack cited decisions in various state jurisdictions in support of the claim of non-compensatory pricing (Massachusetts, Kansas, New York, California, Colorado and Texas). The two-tier pricing structure of the "Dimension" PBX was at issue in many of these cases. States differed in their concepts of an "anticompetitive" price. For example, Massachusetts found that New England Bell's two-tier pricing structure required cross-subsidization by general ratepayers and rejected it as being non-compensatory and predatory, while the Rhode Island Commission found the same pricing format by the same telephone company to be "not anticompetitive". An FCC-sponsored analysis of tariffs for equivalent types of PBXs and key systems indicated a wide variation in prices for non-recurring and monthly recurring costs from state to state, implying that in many states the potential existed for these tariffs to be non-compensatory and anticompetitive.

Mr. Spievack stated that at the time of his testimony (January 1978) members of the interconnect industry were involved in administrative proceedings pending in 32 state regulatory commissions challenging the Bell System's Dimension PBX rates and pricing methods. He concluded that, while the legal conditions for competition were established, much work remained to be done in the United States to devise the conditions necessary for a "fair and open competitive market".

Mr. Spievack and Professor Irwin addressed the question of ensuring a competitive environment for terminal equipment. Mr. Spievack said that three possible solutions were debated in the United States. One (which does not address the issue of cross-subsidization at the operating telco level) is the divestiture of Western Electric and some part of Bell Labs from AT&T. Another is establishing wholly separate corporations which would conduct the competitive activities of the telephone companies. The third method, which, Mr. Spievack testified, the telephone companies themselves were moving towards, is functional accounting to identify the costs associated with the competitive services and isolate them from the monopoly area of service.

In the opinion of Mr. Spievack, competition in the United States is a "regulatory creation" requiring continuing regulatory scrutiny to prevent cross-subsidization. Dr. Irwin argued that there was over-regulation in the United States, especially since telecommunications is now characterized by rapid technological changes. In his view functional accounting, which requires the separation of markets under the same corporate shell, would necessitate even more regulation of a tedious and arduous sort. He testified that, with the exception of IBM,

> "Most industry competitors of Bell who are worried about competing with them have asked for . . . a

> separate corporation, separate plant, separate revenues and separate costs as the device to lend clarity to the whole issue of cross-subsidy."

On May 2, 1980 the FCC released its Final Decision in the Second Computer Inquiry (Docket No. 20828). It found that the public interest required the "adoption of the resale structure of the Tentative Decision with enhanced non-voice services excluded from Title II regulation [i.e., jurisdiction]". The resale structure would apply to those carriers, AT&T and GTE, that have the potential to engage in cross-subsidization or other anticompetitive behaviour. Thus, all CPE* should be separated from the provision of basic services. The FCC ordered also that all carrier-provided CPE be unbundled and all CPE be detariffed and "removed from the jurisdictional separations process and the rate base of all carriers no later than March 1, 1982." Only AT&T and GTE were required to establish separate entities or subsidiaries because "these two U.S. telephone companies have basic manufacturing operations producing large quantities of a wide range of telecommunications equipment." Separation was appropriate in the case of these two companies because they represented "a substantial threat of injury to the communications ratepayer . . . where other regulatory tools would not suffice". Thus, also the resale structure would obligate AT&T and GTE to offer transmission facilities on an equal basis to all providers of enhanced services including their subsidiaries established for that purpose.

Computer Inquiry I and Computer Inquiry II show the Commission's intent and policy of promoting competition in the terminal equipment market. The convergence of computer and communications technology resulted in more sophisticated terminals. Innovation in this field has resulted from the fact that CPE is severable from the transmission service to which it is attached. The carriers have, however, sought to have CPE provided as an integrated part of their regulated transmission service. Docket No. 20829 was deemed closed with the deregulation and separation provision of CPE.

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* Customer-Premises Equipment.

Reconsideration of the Final Decision entailed reviewing the distinction between common carrier offering of basic transmission services and the provision of (unregulated) enhanced services. AT&T and GTE also asked for an extension of "basic service" to include voice and data storage and retrieval applications. On October 28, 1980, FCC adopted a Decision released on December 30, 1980, which re-affirmed its Final Decision subject to some modifications. It is made clear that a basic transmission service is "the common carrier offering of transmission capacity for the movement of information between two or more points", i.e., the "offering of a 'transmission pipeline'", characterized by line-conditioning parameters such as bandwidth, analogue or digital. Thus, the classification scheme for basic and enhanced services set forth in the Final Decision, the determining influence of the end product and the non-discriminatory access by all providers of enhanced services to the transmission services of carriers are firmly affirmed. Dial-It and protocol conversion are examples of enhanced services.

CPE is to be unbundled from charges for transmission service and provided on a non-tariffed basis effective March 1, 1982. The equipment installed prior to that date will be considered as embedded CPE and, after that date, the equipment will be known as new CPE. The averred purpose is to prevent any impediment to the evolution of a truly competitive CPE market.

Satellite Earth Stations requiring licensing do not fall within the CPE classification. Inside wiring and mobile telephone equipment will be considered in Docket No. 79-105 and Docket No. 79-318 respectively to determine their classification.

In accordance with the Final Decision, AT&T is to form a separate subsidiary for the provision of enhanced services. GTE is now excluded, however, from the separate subsidiary resale structure requirement because of its dependence on AT&T toll facilities and because of the importance of its rural service.

The Reconsideration Decision spells out the degree of separation imposed on AT&T's operations:

1. Separate Structure: AT&T must form a separate subsidiary for the provision of enhanced services, which subsidiary cannot own transmission facilities whether "radio" or "wire" but may have its own switching equipment, network nodes and other required facilities.

2. R&D: Sharing, on a cost compensatory basis, of R&D work products in the area of hardware, firmware and generic software is permitted. The subsidiary must perform its own design and development work for non-generic software, or applications programs. This separation condition is not intended, however, "to forestall technological contributions on the part of AT&T to the extent such contributions require some joint R&D work."

3. Information Flow Restrictions:

   (a) Information relating to the basic network must be disclosed to all interested parties. To avoid cross-subsidization, this obligation will extend to all carriers owning basic transmission facilities; and to ensure its fulfillment, AT&T is to file all transactions or arrangements between the parent, affiliates and separate subsidiaries.

   (b) Information relating to R&D may be transferred between the subsidiary and AT&T but only on a fully compensatory basis.

   (c) Customers' proprietary information obtained in the normal course of business, if disclosed at all, must, with the approval of the affected customers, be disclosed to all.

4. Marketing of Network Equipment by the Subsidiary: Affiliates are restricted from acquiring transmission or other network equipment from

the subsidiary if the latter does not manufacture the equipment.

5. Administrative Services: Accounting, auditing, legal services, personnel recruitment and management, finance, tax, insurance and pension services may be shared on a cost-reimbursable basis.

6. Advertising: AT&T cannot advertise CPE or enhanced services on behalf of the subsidiary but institutional advertising is allowed on a joint basis. The purpose is to allow the parent to take advantage of its goodwill and the subsidiary to benefit from it.

### e) Impact of Terminal Attachment Competition

Both Dr. Irwin and Mr. Spievack said that competition in the market for terminal attachments has broadened choice, expanded features offered (particularly on KTSs, PBXs and data modems), enriched R&D, resulted in price reductions by the common carriers and their affiliates, resulted in new carrier accounting techniques to identify revenues and costs more specifically, reduced life-cycle for products and, in general, provided a benchmark to assess and evaluate the economic performance of the carrier industry.*

When asked for specific examples of new products introduced by independent interconnect companies with limited R&D expenditure, Mr. Spievack cited the switch developed by the Rolm Corporation of California. The FCC's Reports in Docket 20003 provided examples of equipment areas where Bell was slow to respond to customer needs: i.e., modems, 10-20-button KTSs (which would pre-empt the more expensive call-director sets) and economical PBXs in the small and medium sizes. Competitive products were said to have filled voids and spurred innovation by AT&T.

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* Although a reduced life-cycle for products increases depreciation expense, it is argued that much of the new technology is cost-saving and thus eventually beneficial in terms of price to the subscriber.

These Reports cited market expansion as evidence of unmet customer needs prior to the introduction of customer-provided equipment. The Second Report concluded that "customer interconnection has benefited the general public" and "has speeded innovation with no discernible deleterious effects upon anyone."

Market penetration figures are debated. In its First Report in Docket 20003, the FCC noted that in 1975 the interconnect companies' share of two main types of telephone company terminal equipment offerings - PBXs and KTSs - was five per cent at a maximum. Mr. Spievack claimed that

> ". . . nearly 85 to 90 per cent or more of the total new added business a year in terminal markets is being captured by the regulated carriers in any event."

The staff commentaries to the Second Report of the FCC remarked that AT&T's losses in the market share for PBXs and key systems peaked in the period 1968-72 but diminished rapidly during 1973 and 1974, owing to the success of Bell's customer-oriented marketing. The future, however, appeared uncertain.

A concern related to this is the effect of interconnect on the U.S. balance of trade. A study, undertaken by the U.S. International Trade Commission and referred to by Northern Telecom during the hearings before the RTPC, indicated that close to 95 per cent of imported branch exchanges (but only 39 per cent of imported key system switching equipment) were sold to firms other than regulated companies in 1977.* Dr. Irwin indicated that the original non-carrier entrants to the industry were largely foreign suppliers, but that a second generation of suppliers developed within the United States - mainly manufacturers of computer-related hardware.

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* Sales to companies other than regulated ones include sales to the interconnect market as well as to part of the small telco market since the small telcos make many of their purchases from distributors rather than from manufacturers directly.

The staff commentaries to the Second Report in Docket 20003 cited a study done for the Department of Commerce which projected positive trade balances for PBXs for 1978 ($36.0 million), 1981 ($60.0 million) and 1984 ($84.0 million), predicting that 1977 would be the last year for a negative trade balance in this area. Northern Telecom, citing the U.S. International Trade Commission study, noted that it shows a growing negative balance of trade for PBXs between 1976 and 1977.* Although the overall import penetration level in the telephone instrument and switching equipment market is relatively low, import penetration is substantial for PBXs. Official Department of Commerce figures indicate the ratio of imports to apparent consumption for private branch exchanges was 13.9 per cent in 1977. This contrasts with a 1977 ratio of 1.2 per cent for telephone sets and 1.4 per cent for central office switching equipment.

### 2. Attachment Policies in the United Kingdom, Western Europe and Japan

The policies of the United Kingdom, Western Europe and Japan, which countries account for about 40 per cent of the world's installed telephones, slightly more than those accounted for by the U.S., differ significantly from those of the U.S.** Throughout the 70s, the average annual combined growth rate of telephones in service in the U.K., Europe and Japan was over 8 per cent, or more than twice the 4 per cent average annual growth rate for the U.S. Although the specific regulations vary from country to country, they have common features. The common carrier is typically a government authority. In Britain, the authority was the British Post Office (BPO). In France, it is the Administration des Postes et Télécommunications (PTT); in Germany, the Bundespost; in Japan, the Nippon Telegraph & Telephone Public Corporation (NTT). Residential telephone service, including the telephone terminals, is a carrier monopoly. The connection of PBXs and KTSs, however, is widely permitted.*

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* Although some evidence does show this, other evidence in the same publication shows the opposite, i.e., a slight drop in the negative trade balance for PBXs.

** The U.S. accounts for close to 37 per cent, Canada for 3.4 per cent, and Eastern Europe and "other" countries for the remainder. These percentages are based on available data with non-reporting countries being omitted.

In all cases the regulations require carrier approval of terminals to be connected to the network. Many require that private contractors be licensed or authorized. The number of licensed contractors varies. Mr. C.C.W. Box-Grainger, Group Marketing Manager, Telephone Rentals Limited, London, England, who appeared before the RTPC in January 1978, reported that Britain had eight authorized contractors for privately supplied PBXs and KTSs (six of whom were also manufacturing companies), while France had over 500. Carrier provided after-sale maintenance is required in some countries (e.g., Britain) but not in others (e.g., France and Germany).

In the U.S., the approval process (FCC certification) primarily protects the network. By contrast, in these other countries it also serves to protect selected suppliers, usually local ones. Mr. J.D.M. Davies, Vice-President, Business Development, Northern Telecom Limited, testified as follows with reference to PBX approval procedures outside North America:

> "National imperatives, implemented by the requirement/approval procedures, result in the

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* There are exceptions. The Netherlands, Sweden and Norway do not allow interconnection. Nor is it allowed in parts of Finland, Denmark and most of Switzerland. Also, even if interconnection is permitted, some countries insist on the telcos supplying items of certain line sizes.

> exclusion of the non 'club' members. These procedures can involve the meeting of specifications and requirements respecting not only the system structure of the PABX and its performance but, as well, its components and its design. It may even be difficult for an outside supplier to obtain a copy of the required specifications. Where opportunities do exist to submit a PABX for evaluation, approval is rarely forthcoming. Germany, for example, restricts the suppliers that may apply for approval. France, Spain and South Africa quite openly insist on local manufacture. The process of obtaining approval can take years and involve the expenditure of many millions of dollars. In the result, few non-indigenous suppliers are prepared to assume the risk of seeking approval knowing that if approval were to be granted it would probably be after the product is outdated or would be subject to requirements which would make the equipment non-competitive."

The "club" members are the traditional suppliers of telecommunication equipment to the national telco. Mr. Davies noted that approval for PBXs on private networks, i.e., not interfacing with the public network, is not difficult to obtain in Western Europe and the U.K., but that the market for them is minor. He also specified that, in some of these countries, minor peripheral products, certain special advanced technology and data-type products can be sold.

# CHAPTER VII

# EQUIPMENT OPTIONS

This chapter deals with some of the complaints lodged with the Commission by users and sellers of terminal equipment. It concentrates on the witnesses' experience in obtaining or marketing terminal equipment in Canada, since it is felt that no particular purpose would be served by an account of all of Canadian users' views of the benefits which have occurred in the United States from COAM.

Several Canadian users' presentations included lengthy and detailed comparisons of the costs of acquisition and installation they would incur if purchasing their own PBX equipment from non-telco sources in the U.S. for use in Canada, with the cost of renting a PBX from a Canadian telco. Such comparisons are necessarily inconclusive. Although the present monthly rentals and one-time installation costs of equipment secured from a telephone company can be ascertained with considerable accuracy, the same certainty and precision do not obtain when one considers purchase and installation from non-telco sources in the future. Moreover, Bell Canada itself has stated during the hearings that its terminal equipment prices are high and that they serve to subsidize the cost of ordinary telephone service. Although the figures presented by Bell were not set out in sufficient detail for conclusions to be drawn on the net revenue obtained from terminal rental, the conclusion that the cost to subscribers is higher than would prevail if terminal connection were permitted is not in dispute.

## 1. Users' Complaints

Consultec Canada Limited, a company engaged in providing consulting services in telecommunications to government and business, is one of several firms or organizations that complained about the range of available equipment options. The telcos, said Consultec, were trying unsuccessfully to cope with rapid continuing technological progress and were not facing up to the task of presenting new products or meeting the greater demands by users. The telcos' inability, according to Consultec, arose out of their perceived need to standardize on one or two items of equipment for a particular function in order to gain the economies involved. Standardization resulted in the telcos' lengthening response time and consequently in business firms' lost time and productivity, since the latter require a broad selection of equipment to permit them to find the right machine and the right features for each application. The lack of an adequate selection of available new products and the inability to interconnect, Consultec claimed, were costing Canadian firms millions of dollars every year and causing them to fall behind firms in the United States.

Similar evidence was given by Telcost Limited, of Toronto, also a consulting firm, which analyzed clients' telephone systems with a view to reducing their costs and improving their systems. In some cases, Telcost found clients over-equipped, but in other instances, under-equipped in relation to their needs, and claimed it had been able to effect savings ranging from $2,000 to $80,000 per year.

In some cases, Telcost attributed the inefficiency to subscribers' ignorance of telecommunication systems and their total reliance on Bell Canada, but in other cases, to a void in the offerings. Multi-line telephones constituted a case in point. Mr. P.G. Ouellette, of Telcost, said that, while 5-line telephones were available, the next largest was an 18-button (17-line) "Call Director", much more expensive than a 6-button telephone. He said that "a few years ago" Northern Telecom had partially filled the gap by introducing a 10-line telephone.

Mr. W.C. Short, of Independent Telephone Technical Agencies, Inc., Vancouver, complained that he could not market a 14-, 16-, or 18-button key telephone with a built-in, handsfree receiver.

According to Mr. Ouellette of Telcost, a gap also existed in the Canadian telcos' offerings of traffic data analyzers and toll restrictors. Both devices were available in the U.S. Traffic data analyzers are computerized. They are of two types, passive and active. The passive type, which was available from Bell, analyzed historical data on telephone calls for cost accounting purposes and in order to determine the number of lines and amount of terminal equipment an organization should have. The active traffic data analyzer, a more sophisticated form of the same machine, also provided analysis of historical data; but in addition it provided call routing. If a telco subscriber had arrangements for several types of toll facility, the traffic data analyzer would decide which of the services to use to minimize the cost of a call and then route the call through the network. The equipment was not available from Bell on a "stand-alone" basis. Mr. Ouellette thought, however, that Bell Canada's "Centrex" system, if provided in a small-scale version, would be an applicable solution in some situations, e.g., branch operations of larger companies.

Another gap in Bell Canada's product line, he said, lay in multi-path intercoms. Bell Canada offered one- or two-path intercoms, but a subscriber requiring more paths would be forced into a switchboard system.

Where Bell Canada did not have available in its regular tariff the equipment required to solve a subscriber's problem readily, Telcost recommended special assemblies.

The major thrust of the evidence of Commonwealth Holiday Inns of Canada Limited related to a comparison of the cost of equipment available from Bell with that of equipment available in the U.S. In another part of its evidence, Commonwealth, which drew on the consulting services of Parsec Communications Limited of Toronto in the preparation of its brief and the presentation of its evidence, claimed that the most modern hotel telephone equipment, with features designed to provide various specified services to hotel guests and hotel management, was not available in Bell Canada's territory although it was readily available to American hotels. Commonwealth claimed that its standard of service was consequently impaired in comparison with American hotels.

Moreover, older equipment available from Bell involved higher labour and space costs. Commonwealth, claiming that Bell was slow to respond to hotels' needs, cited its attempts to acquire message registers, which record the telephone calls made by guests, and auxiliary printers from Bell Canada in December 1974. Although both registers and printers were then available from a distributor in London, Ontario, the registers - without printers - were only installed in Commonwealth's hotels in the first quarter of 1978. The printers were not yet installed in October 1978.

Mr. A.V. Groom, owner of Garden of the Gulf Court & Motel, Inc., a motel in Summerside, Prince Edward Island, complained in May 1978 about The Island Telephone Company Limited's rules and regulations governing the availability and installation of telephone equipment, saying that Garden of the Gulf was forced to buy exactly what the telco had to sell on a "take it or leave it" basis. Garden of the Gulf cited its experience in 1973 when it decided to install an Ericsson automatic PBX to replace the existing manual switchboard. Island Tel had available one model which could serve fifty rooms and a second model with a much larger capacity which exceeded the number of rooms of the Garden of the Gulf motel - sixty. Although Garden of the Gulf proposed installing fifty phones and leaving ten rooms without service (in order to permit the use of the smaller PBX), the telco insisted that all sixty rooms be equipped with telephones. Later, however, Island Tel became more flexible. During the negotiations in 1978 with Garden of the Gulf, following Mr. Groom's appearance before the Commission, the telco indicated that the motel could obtain any number of telephones it wished. As reported in Chapter V, Garden of the Gulf's application to the Public Utilities Commission of P.E.I. to interconnect a PBX to be purchased from a non-telco supplier was denied. However, in June 1981, the Supreme Court of Prince Edward Island ordered interconnection of this equipment following the adoption by the telco and approval by the Commission, as directed by the Court, of appropriate regulations.

The evidence of the Canadian Airlines Telecommunications Association concerned the higher cost of telecommunication services of its members in comparison with those of airlines in the U.S. The Association cited higher, private line long-distance transmission costs and more limited-equipment availability and financial options in Canada. In the matter of equipment availability, it stated that Canada lagged behind the U.S. seriously. The Association cited the experience of CP Air in trying to obtain electronic automatic call distributors (EACDs), which were available in the U.S. in 1973, as an example.

The purpose of an electronic automatic call distributor service is to have a PBX system perform the function of uniformly distributing incoming calls among agents or attendants and of monitoring and recording their work load. Early in 1977, after studying the ACDs of Rolm Corporation, LM Ericsson Limited, TRW Canada Limited and Collins/Rockwell International, CP Air applied to Bell Canada to have an automatic call distribution system installed in its new Toronto reservations office. In September 1977, after various negotiations, CP Air asked Bell Canada to be allowed to purchase an Ericsson ASDP 162 and connect it to the network. Upon this proposition being refused, CP Air proposed that Bell purchase it and re-lease it to CP Air. This last proposition was considered impractical by Bell on the basis that the special assembly rates would be much too high. In February 1979, after various meetings and negotiations, CP Air again gave consideration to the systems of TRW Canada Limited, LM Ericsson and Rolm Corporation. Faced, however, with losses in reservation calls and related revenues, CP Air felt it had to agree to the installation by Bell of Northern Telecom's SL-1 ACD which had undergone a field trial at Wardair in November 1979, and was finally installed at CP Air in March 1980. At that point, CRTC had given only interim approval to the installation, i.e., to the rates for the new equipment. Further improvements had to be made to the system to meet CP Air's requirements but these were not expected prior to the first part of 1981. ACD equipment, although not network addressing, had not been certified under TAP.

Testimony of an employee of The Royal Trust Corporation dealt with Royal Trust's difficulties in acquiring the kind of telephone equipment it wanted for its real estate offices in Ontario, Quebec and Nova Scotia. Royal Trust, seeking to secure the installation on its premises of improved equipment with features in addition to or different from those of the telcos' standard offerings and seeking lower costs, also proposed that Bell and MT&T allow it to install the Plessey K-1 Key System/PBX because it was dissatisfied with the equipment made available by the telcos as a standard offering. Both telcos refused. Subsequent negotiations with MT&T resulted in a proposal from the latter that promised to give Royal Trust eventually all the features it wanted and at a cost considerably lower than that of the equipment then installed in the company's Halifax offices. During the negotiations with Bell Canada, Royal Trust rejected the PBX which Bell proposed as the equipment best suited to Royal Trust's needs. However, the prospect at the time of the hearing in the fall of 1979, was that early in 1980 Bell Canada would be making available, in Ontario and Quebec, as a standard PBX offering, the same PBX (the Mitel SX-200) which Royal Trust would be securing from MT&T.

While most PBX users' complaints were to the general effect that they were having difficulty in getting technologically advanced equipment with special features adapted to their particular requirements from the telcos, the Ontario Hospital Association (OHA) was concerned that an older piece of equipment, the 701 PBX, would no longer be supplied by Bell Canada. The 701 PBX was installed in about 55 per cent of the Association's member hospitals for which it presented data. The 701 was, however, no longer manufactured. The OHA wanted Bell to continue to make available 701 equipment, or some system comparable in cost and function, as long as any of its members needed it or wanted it. The reasons advanced were that: the 701 met the needs of many of its members; the need for feature-oriented services was limited; and the cost effectiveness of more elaborate systems was questionable. The OHA claimed that services provided by more elaborate PBXs could increase costs by 30 per cent or more.

Bell stated that although the 701 was no longer manufactured, the company anticipated that returns to stock would enable it to meet requirements for 701 PBXs for several years; furthermore, that it would maintain and support the 701 systems for as long as was "reasonably possible and desirable by hospitals". Some hospitals, Bell added, had decided that other forms of PBX service could better meet their requirements.

The OHA's position was that all users of telecommunications should have the right to alternatives at reasonable costs when dealing with Bell Canada; and, if the latter were unwilling or unable to provide required basic services at reasonable cost, Bell's "stranglehold" over the supply of systems should be relaxed to allow users access to alternate sources of equipment.

One document filed by Bell Canada was a report prepared for it by an outside firm. The report showed that, of the 85 Ontario and Quebec hospitals which had responded to the firm's questionnaire-survey, 21 per cent would have preferred to purchase telephone equipment outright, 16 per cent would have preferred to purchase it over time, 19 per cent preferred to rent it from Bell, and the remaining 44 per cent either did not answer the question or did not know whether they preferred purchasing or renting.

Mr. C.J. Stephens, General Manager, TASCO Telephone Answering Exchange Limited, Vancouver, devised equipment which would reduce the number of his offices and eliminate some of the line charges. The equipment was being manufactured and sold in the United States. The device, he said, would eliminate multi-office operation, replace old-fashioned switchboards by modern electronic equipment, and save 30 per cent of TASCO's operating costs.

He approached B.C. Tel for permission to interconnect the call diverter but B.C. Tel refused even though it had not offered equipment to help TASCO solve its problem. Later B.C. Tel refused TASCO permission to use a call diverter even with the use of a coupler. As an alternative, B.C. Tel offered a device called a "concentrator identifier" which permitted answering telephone calls in areas where TASCO does not have an office in a central location. TASCO, however, had found it unreliable and inefficient and, for three years, had asked B.C. Tel for more up-to-date equipment, to no avail.

## 2. Financial Options

The telcos make their tariffed equipment available solely on a rental basis. Until recent years, this meant that a single charge applied per unit of time. Following interconnection in the United States, however, AT&T introduced so-called "two-tier" pricing for its operating telcos, undoubtedly in order to meet the competition from interconnect companies. Bell Canada and B.C. Tel adopted two-tier pricing in the mid-70s. Bell first introduced it along with its newest PBX offering, the SL-1, then extended it to the SG-1 and finally to older equipment offerings.

The difference between two-tier pricing and traditional tariffs for equipment rental is that the rental charge, instead of being a single monthly charge to cover all costs of the equipment to the telco, is divided into two parts. For one part, "Tier A", which is principally associated with the cost of the equipment, the rental charge varies inversely with the length of the contract entered into by the subscriber; or the charge can be paid as a lump sum. "Tier B" is a continuing monthly rate which remains payable for as long as the subscriber rents the equipment. Bell provides alternative contract periods of one month or three, five, seven or ten years for payment of the "Tier A" charges. The one-month contract would appear to be designed to provide subscribers an opportunity to try the equipment without getting locked into a lengthy commitment.

Originally the "Tier A" rate for the SL-1 reflected the costs of providing the equipment and the "Tier B" charge reflected the ongoing expenses (such as maintenance and administrative costs) of continuing the service. The relationship between costs and rates was modified, Bell stated, by the need to fit the SL-1 into an existing product line. Bell allocated 70 per cent of the total costs to "Tier A" charges and 30 per cent to "Tier B".

B.C. Tel requires that the customer pay an installation charge in addition to "Tier A" and "Tier B" charges. The "Tier A" charges in the case of B.C. Tel are said to comprise capital costs and related fixed expenses. They can be paid in a lump sum or in monthly payments over contract periods of three, five, seven or ten years.

Bell customers who choose to terminate their contract before it has expired are required to pay termination charges. Under a contract period of three years for the SL-1 or SG-1, the termination charge is 15 per cent of the "Tier A" charges still due. In contrast, termination charges under a 10-year contract are 45 per cent of the "Tier A" charges still due, because the monthly payments are considerably higher under the three-year contract. In Bell's request to the CRTC to extend two-tier pricing to older equipment, the termination charges were to be set at the discounted value, at Bell's cost of money, of the payments due to the end of the contract term. Although B.C. Tel uses the same method of establishing termination charges, B.C. Tel agrees to adjust the termination charge if it can re-use recovered equipment by leasing it to another customer; and, if the customer is dissatisfied with the reimbursement, he may refer the matter to the CRTC.

Two-tier pricing protects customers against increases in the cost of equipment. In the case of B.C. Tel, such protection covers a period equal to the longest contract period, which is ten years. Bell's customers receive protection for 14 years, the period for which Bell binds itself to provide and maintain the equipment covered by the contract.

Two witnesses commented on the financial terms available from Bell. Commonwealth Holiday Inns complained that Bell Canada did not make available to PBX users the several alternative acquisition plans which suppliers in the United States provided. It was noted that in the United States manufacturers made equipment available for lease-purchase or for outright purchase as well as for rent, whereas the only method of acquisition that Bell Canada offered was rental.

Mr. A.R. Robinson of Royal Trust was of the view that the termination charges tended to lock customers in, and he felt that this was disadvantageous because product cycles of five to seven years could be anticipated. His view, however, appeared to be based on the impression that only contracts for ten years were available and that the commitment by Bell to provide the equipment in question for 14 years somehow committed the customer.

## 3. Distributors' Complaints

The Commission heard from a number of distributors in addition to consulting firms and large users. Much of the distributors' evidence concerned their attempts to sell or install COAM equipment and Canadian telcos' attempts to prevent it from being connected to their networks. This chapter is concerned with such evidence only to the extent, however, that the telcos' refusal to permit connection of products or COAM equipment resulted in the public's being denied equipment.

Harding Communications Limited's opposition to Bell's policy regarding the interconnection of the call forwarders Harding had sought to sell to the Bank of Montreal is covered in Chapter V. In his appearance before the RTPC, Mr. R.W. Walton described other products marketed by Harding, which went out of business, and later by The Dictograph Corporation Ltd.

Harding introduced to the market in 1976 the "Attaché" mobile telephone which Harding had developed in conjunction with a British firm, Dodwell Manufacturing, and which was manufactured in Canada. The "Attaché" could be used in an automobile or it could be detached, put into a briefcase, and carried around. Calls to the subscriber could be forwarded to the telephone in the briefcase. A module was added for direct dialing into the telephone system. Mr. Walton claimed that the unit had better range and greater versatility than Bell Canada's offering and that Harding's price for it was within $5 of Bell's charges at the end of sixty months. Even though DOC had approved the "Attaché", Bell attempted to keep it off the network by simply refusing to assign telephone numbers for the telephone. At the same time, Bell continued to give numbers for fixed mobile telephones in automobiles. According to Mr. Walton, Bell Canada's mobile telephone was limited to four channels, lacked versatility and security, and could not be used outside the

Toronto area. Harding was able to sell the "Attaché" in Canada except in Bell Canada's territory.

The Dictograph Corporation assembled and distributed intercoms, including the "Voycall", which was made in California but adapted and brought up to date by the Canadian Dictograph Corporation. It comprised a handset (which could be used as both telephone and intercom), five lines and a "hold" button. The machine was a touch-tone device on both the telephone and intercom functions. It permitted holding a telephone conference in which all five lines were open and the caller could talk to five different locations simultaneously. It had a built-in speakerphone. Mr. Walton, appearing for the company, said the telephone could give access to an in-plant paging system and directly to a two-way mobile communication system. He also indicated that Canadian Dictograph's modified "Voycall" was different from the "Voycall" available in the U.S. and that it was partially manufactured in Canada. Although some of the functions performed by the Canadian "Voycall" may have been available from Bell as a service (e.g., conference calls), this capability was not built into the telephone equipment offered by Bell Canada, he said.

Furthermore, according to Mr. Walton, Bell Canada offered conferencing as a "special deal" which the customer had to order from Bell and which involved many "add-on" items and additional charges which would put the cost of the arrangements out of reach of most users.

Mr. Walton indicated that he had designed another telephone which would include all the "Voycall" features plus a 10-memory dialer, call forwarder, an intercom, a calculator, a digital clock and a message recorder. He said he could not get it manufactured in Canada because telco interconnection policies meant there would be no Canadian market for the product and it would have to be sold on the export market only. He also mentioned his design of a cordless extension telephone which he intended to manufacture in Canada but sell in the U.S.

Two New Brunswick companies, Altron Electronics Ltd. and Electronic Industries Limited, both of Moncton, testified as to their unsuccessful attempts to sell communication equipment.

Mr. E.A. Belliveau, President of Altron, complained that NBTel's refusal to interconnect telephone intercom systems necessitated a duplication of equipment and hence increased costs. Mr. W.J. Gillis, of Electronic Industries, also discussed intercom equipment, in this instance the "Voycall", which he described as a solid-state telephone intercom system combining a telephone and an intercom in one unit, for which Electronic Industries had exclusive distribution rights for New Brunswick and Prince Edward Island. NBTel's refusal to interconnect meant that Electronic Industries had to provide customers with extra microphones at added cost. Mr. Gillis said that he had not attempted to get NBTel's permission to interconnect the "Voycall" because he knew in advance that the answer would be "No", hence that he had to tell customers requesting the "Voycall" that it was not available. He said that NBTel did not offer any equivalent device although the "Voycall" was offered by AGT, Sask Tel, 'edmonton telephones', and Thunder Bay Utilities.

Both witnesses testified that NBTel required the use of couplers where intercom equipment was connected to the network, in their opinion solely to give the telco a competitive advantage, a complaint echoed by almost all sellers of intercom and telephone answering equipment.

Mr. Belliveau stated that Newfoundland Telephone had refused to allow intercom systems supplied by Altron to be connected to its network and that as a result Altron lost to the telco a $1-million hospital contract for a complete communications package. He said this situation prevailed in many locations in the Atlantic provinces.

Mr. M. Mahony, of Cardinal Communications Ltd., of Edmonton, said that Cardinal had restricted itself to the market for telephone answering machines. Mr. Mahony stated that there were various devices, all approved by the FCC and available for attachment in the United States, that he could not sell in Canada because they were network addressing devices and because AGT had refused to permit their connection. These included an automatic dialer, a portable automatic phone dialer with a memory, a call diverter, a device which creates a "hold" condition which releases automatically when any extension is picked up, a portable cordless telephone, and a calculator telephone.

Bartronics (1972) Limited, of Edmonton, designs and assembles specialized telecommunication equipment. One such device was a "microprocessor control DTMF converter" to link mobile telephones with a telephone network. Bartronics designed and assembled the system and sold it to AGT only because, according to Mr. R. Barnes, President of Bartronics, AGT would not permit this equipment to be connected to the network and because it could not be sold on the open market. He indicated that a large user such as Calgary Power could get the system he supplied but that smaller businesses (such as a small taxicab operator in Medicine Hat) could not obtain it.

Distacom Communications Limited, of Vancouver, complained that B.C. Tel had prevented it from installing a call diverter or call forwarder manufactured in the U.S., a device to receive incoming calls and "hold" the caller while it dialed another number. Distacom stated that although the demand for this equipment was high, Canadian telephone companies prohibited its use.

Mr. J.T. Bryson, of Tell A Phone Systems Inc., of Vancouver, sold Northern Telecom's SK-1 intercom system, an electronic, hold, three-line-and-intercom-plus-buzzer system (making a total of five lines) also available with four lines plus a push button for a buzzer. He said that B.C. Tel provided three-line and five-line sets, but no four-line sets. The three-line set (Type 187), made by GTE, came as a three-line telephone or with two lines plus an intercom, with a mechanical hold press button (not electronic) for the buzzer circuit. If a B.C. Tel customer owning a Type 187 machine wanted an extra line or an intercom, he had to take the GTE 1082 key system, which is a five-line system.

Mr. Bryson also discussed the mini-coin telephone, a coin-operated telephone pay station intended to be owned and operated by the proprietor of a small business. The device is attached to an ordinary telephone and the owner, not the telco, can collect and retain the coins.

Sacom Communications Ltd., of Montreal, developed an "identified call forwarding unit", a microprocessor switch (also called a "CFU-1A call diverter") for use with a telephone answering service. This product was being sold by Sacom to an American firm, Telephone Communications Incorporated. Mr. E. Meitner, of Sacom, indicated that the company had developed another product, an "annunciator", a piece of central office equipment used to decode the information sent to it by the CFU-1A, and designed to be connected to the network by a coupler. Only two of them had been sold, neither in Canada.

Sacom did not attempt to market its products in Canada because of its fear that Bell would prevent their connection to its network. The inability to connect equipment to the network during the development stage also held back the development process because Sacom was forced to have network testing performed in the U.S.

Mr. E. Meitner, of Sacom, said he knew of only one product similar to or competitive with his identified call forwarding unit. It was made in the United States and sold there for approximately the same price as the Sacom product.

The Commission also heard evidence from a number of telephone retailers including Global Telephone Systems, House of Telephones, The Telephone Store Limited and Radio Shack. In large measure these outlets were offering telephones manufactured by Northern Telecom and GTE, some imported from the U.S. They also offered a number of inexpensive telephones and decorator telephones. These firms sold other types of terminal for the home or for small business which have already been mentioned: call diverters, telephone answering equipment, automatic dialers, speaker telephones, and telephones with a number of calculator-like features, such telephones being almost invariably non-Canadian. For the most part, the same or similar equipment was available from the telcos. Their evidence is thus chiefly concerned with their difficulties in marketing COAM equipment despite the opposition of Bell Canada, which was renting the same products.

Mr. A.R. Monk, of House of Telephones, formerly with The Telephone Store Limited, objected to Bell's policy of requiring a coupler when a subscriber obtained a telephone answering machine from a non-telco source, such as the House of Telephones, since the same equipment was available from Bell's own telephone outlets.

Bell Canada required that a subscriber wishing to connect his own telephone answering equipment to Bell's network secure a coupler from Bell and pay a monthly rental. According to Mr. Monk, these couplers were unnecessary, for he had installed hundreds of telephone answering devices without couplers, against Bell's wishes, without any problems. Moreover, he claimed, when Bell installed a coupler, the telephone answering device rarely worked, and The Telephone Store's repairman would bypass it; thereafter, there would be no pressure from Bell, which had received a fee for installing the coupler and a continuing monthly payment of $2.45 for the useless product. According to Mr. Monk, Bell's coupler-installation service was slow and, in any event, unnecessary, for the customer could have installed the plug himself.

Mr. A.R. Monk and representatives of Radio Shack complained about the effect of TAP standards on their ability to import equipment. Mr. Monk claimed that Noresco's and Philips' telephone answering equipment had to be modified at considerable cost before they could be imported for use in Canada. He also stated that every piece of equipment that The Telephone Store submitted for examination - equipment approved by the FCC for use in the U.S. - had been rejected without exception and that American and Japanese factories had to modify their products to satisfy DOC's specifications.

Radio Shack, a Division of Tandy Electronics Limited, started in 1972 to offer the Canadian consumer interconnection products including standard, decorative, and reconditioned telephones, a telephone answering device, a telephone amplifier system, and various plugs, jacks, and connectors. It withdrew for a time, from the Canadian market, network addressing equipment, such as telephones, as a result of the telcos' interconnection policies. Some of the products had to be redesigned to meet the Canadian requirements for certification under TAP that were more stringent than the FCC's rules and regulations for interconnection products.

One item withdrawn for a time from the Canadian market was the "Duofone" automatic telephone answering system. Radio Shack offered it for sale in Canada through its catalogues in 1974-75-76 but not in 1977. For a time Bell Canada permitted the "Duofone" to be attached by means of a voice station coupler which Bell rented to subscribers for that purpose. The coupler, however, prevented the owner from using the Duofone's telephone handset to record a message, and, since there was no separate microphone, Bell suggested to Radio Shack that such external microphones be added to the "Duofone". One of the purposes of the Duofone's design, however, had been to reduce significantly the cost of a telephone answering machine by using the ordinary telephone receiver instead of a separate microphone to record answering messages. Although the "Duofone II" as modified for Canadian use was not on the market on December 15, 1977, Radio Shack then expected to have it for sale in four months' time.

Another device which Radio Shack withdrew from the Canadian market because its attachment was contrary to the telcos' rules was a conference telephone or ("hard-wired") electronic telephone amplifier system. It was offered in Radio Shack's Canadian catalogues in 1975 and 1976 and then withdrawn. These conference telephones permitted the incoming voice to be amplified "to room-filling volume" and left users free to move around a room while both listening and speaking.

Mr. T. Malizia, of Global Telephone Systems, testified that his company developed a "touch-pulse" telephone. The basic set was secured from GTE but Global added circuitry which he claimed was simpler than that in GTE's or Bell Canada's equivalents. Basically, the "touch-pulse" telephone did the same thing as Northern Telecom's digipulse telephone, but with an extra feature: it would repeat the last number dialed. Global intended to manufacture it, said Mr. Malizia, utilizing some parts manufactured in the U.S.

# CHAPTER VIII

# CONCLUSIONS AND RECOMMENDATIONS

This chapter covers the policy questions raised by the interconnection of terminals. The central points as seen by Bell, Northern and B.C. Tel are summarized below.*

> All three recognize that there would be advantages to telecommunication users from the wider choice of equipment and of financial terms that would result from an increased number of suppliers.

They expressed concern over the costs and implementation problems involved:

> The replacement of telephone company purchasing of terminals by freer market forces would lead to increased imports of terminal equipment which would seriously weaken Canadian research, development and manufacturing capability. Moreover, many of the potential foreign suppliers of the Canadian market are free from import competition in their home markets because of the purchasing practices of government-owned telephone companies there.
>
> Technological development of the network could be delayed if owners of terminal equipment which would

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* Of those parties who participated in the Inquiry, the Government of Ontario, B.C. Tel, Bell, Northern and the Director of Investigation and Research presented final arguments.

> be incompatible with future changes in the network were allowed to delay such changes. Of particular concern is the fact that although the greatest part by far of terminal equipment for voice traffic is analogue, there is already a gradual change to a digital network underway in central office and toll switches and in long-haul transmission.
>
> The quality of the network could be adversely affected if suitable standards were not set for the equipment to be attached to the network and if the equipment were not well maintained.
>
> Rental of terminal equipment yields a higher-than-average return to Bell. Competition in the provision of this equipment would erode these returns and result in higher rates for other services, the most likely area of increase being local rates for households. B.C. Tel has stressed the financial impact during the transition as telcos would be forced by competitive pressures to move to more rapid depreciation rates.

The Director has proceeded on the premise that interconnection will go forward and has concluded that it would be desirable for Bell to participate as a supplier in this market. The focus of the Director's argument has been on the conditions he sees as necessary to create a competitive terminal market, and in particular on the restrictions which must be placed on Bell to keep it from building on its entrenched position to dominate the supply of terminals. The Director recommended that the Attorney General of Canada should seek an order under section 30(2) of the *Combines Investigation Act* which would set out the conditions under which Bell would be permitted to compete in unregulated markets. The Director prescribed the following conditions:

> "1. Bell Canada should be prohibited from engaging directly or indirectly in the direct sale of terminal equipment and installation of such equipment on any subscriber's premises unless such activity is carried out through a separate arm's length subsidiary. The subsidiary should

maintain its own books of account and should be prohibited from sharing with Bell Canada similar officers, employees, facilities and proprietary customer information.

2. Bell Canada should be prohibited from providing any financing to the separate arm's length subsidiary or in the alternative, if Bell Canada provides financing, the subsidiary should be required to issue shares to the public. In either case, Bell Canada should be prohibited from guaranteeing the debt of the separate arm's length subsidiary.

3. Bell Canada should be prohibited from selling or transferring assets to the arm's length subsidiary at terms unavailable to other companies. The subsidiary should be prohibited from obtaining any services, facilities, non-proprietary information or equipment from Bell Canada or its affiliates on other than an arm's length basis. The terms of sale for transfer of assets, services, facilities, non-proprietary information or equipment should be reduced to writing and such records filed at appropriate intervals with the Court issuing the Prohibition Order.

4. Bell Canada should be prohibited from granting itself, directly or indirectly, a preference in the configuration or arrangement of terminal equipment sold to subscribers where competitors are not permitted to install subscriber-owned equipment on the basis of similar configurations or arrangements.

5. Bell Canada should be prohibited from obtaining an exclusive distributorship for the purpose of direct equipment sales of any equipment manufactured by Northern Telecom. Bell Canada should also be prohibited from obtaining exclusive distributorship for the purpose of direct equipment sales from any other manufacturer unless the distributorship related to equipment that

Bell Canada or Bell Canada's subsidiary has jointly developed with a Canadian manufacturer.

6. Bell Canada should be prohibited for a period of five years from acquiring, directly or indirectly, any company competing directly or indirectly with Bell Canada with respect to the sale of equipment."

The Province of Ontario has taken the position that interconnection is desirable provided that the equipment of manufacturers whose home markets are closed to Canadian producers is not allowed access to the Canadian market. As in its appeal to the federal Cabinet from the interim decision of CRTC, the Ontario Government has argued that any access to the terminal equipment market in Canada granted to foreign suppliers should be part of reciprocal agreements granting Canadian suppliers equivalent access to the foreign suppliers' home markets.

The positions taken by the parties in final argument reflect serious policy concerns which must be addressed. The following does this in detail. The principal results are summarized below:

1. Customer ownership of terminals and an increased number of suppliers would be a growing source of increased efficiency and must be accommodated.

2. Unregulated sale and rental markets should be permitted to develop in terminal equipment.

There are reasonable solutions to the various concerns expressed by Bell, Northern and B.C. Tel about the difficulties which interconnection might create:

3. Although interconnection would result in increased sales of foreign-made equipment in Canada, the Canadian industry has reached a level of strength and maturity sufficiently high that it is not premature to expect fair competition in the Canadian market. Steps must be taken, however, to ensure that markets closed to

imports through non-tariff barriers are made accessible to Canadian manufacturers in accordance with the spirit and the letter of GATT.

4. To the extent that net revenue from terminal equipment rental has served to keep local service rates down, and should it be considered desirable for this cross-subsidy to continue, it would be very easy to apply or increase extension and network access charges for extension telephones, PBX trunks and lines for key-telephone systems to make up for any such losses in revenue.

5. Standards should be established through the Terminal Attachment Program for all terminal equipment and a deadline should be set by the government for the completion of this task. CRTC should have the authority to review standards should parties to the certification program establish to its satisfaction that the standards were unnecessarily restrictive and would eliminate certain equipment from the market.

6. The telecommunication companies must be assured that a planned and orderly transition of the networks can occur. To ensure that this will entail little risk or cost to owners of terminals, the maximum possible notice of changes in the network should be given to the public.

7. To assure an orderly transition and fair and unfettered competition in the terminal market, it is recommended that the year 1990 be the time set for the deregulation of all terminal equipment. This would provide a sufficient period of adjustment for the telcos, CNCP and their subscribers.

8. CRTC's requirement in its interim decision on interconnection that subscribers obtain their basic telephone service from the telco (telephone company) should be continued until

further experience with interconnection is obtained.

9. Regulated telecommunication carriers (telcos and CNCP) should be permitted to sell or rent equipment, except single-line telephones, without filing tariffs with their regulators. These offerings should be made through arm's length subsidiaries so that cost and net revenue separation from regulated activities can be achieved.

10. All suppliers of terminal equipment should have equal access to lists of non-household subscribers who rent key systems and PBXs from the telcos, arranged in some meaningful way such as by area, equipment category or line size.

11. Telecommunication carriers should not acquire interconnect sellers competing against them. As well as probably being anticompetitive, such acquisitions would raise doubts about the reason for allowing the regulated carriers to participate in unregulated markets, i.e., the important contribution they can make as the result of their previous experience as suppliers of terminal equipment.

12. Bell and B.C. Tel should not directly or indirectly acquire terminal equipment manufacturing companies in Canada which are in competition with those telephone companies' affiliates.

13. Telecommunication carriers should also be prevented from utilizing their buying power to obtain exclusive selling rights to terminal equipment on their own behalf or on that of their subsidiaries.

## Regulation of Terminal Equipment Distribution

A useful starting point in considering the interconnection question is to inquire whether the characteristics of terminal equipment supply are such that continued supply by a single seller is desirable. It is generally taken as given that regulated monopoly is required only when the attempted introduction of competition would result in higher costs, or that because of cost conditions the number of sellers would collapse to a single seller charging higher prices than under regulation. There is nothing apparent in the sale, rental or servicing of telecommunication terminals which suggests that these services would be most efficiently provided by a single firm. It is also important to note that this claim has not been made by Bell or by B.C. Tel in their final argument.

Several of their arguments, nevertheless, stress the advantages of a single seller on the ground that there are difficulties in separating the distribution and servicing of terminals from the provision of telecommunication services. Under traditional telco ownership of terminal equipment, the telco assumes responsibility for ensuring that the terminal equipment is in good state of repair. When a customer experiences difficulty in transmission, the telco's service personnel deals with the problem whether the fault lies in the terminal equipment or in the line. In the view of Mr. F.E. Ibey, under a system of customer-provided and -maintained terminals the customer would have to pay for a service call and should the fault reside in the terminal, have to arrange and pay for its repair. Should there be any difficulty in determining the source of the poor transmission, disputes over payment for service calls could arise.

It is reasonable to anticipate that household subscribers and, B.C. Tel argues, some business subscribers who are experiencing financial difficulties, would allow the maintenance of equipment to slip in comparison with the levels of maintenance which now prevail. While it might be assumed that all subscribers would have some incentive to ensure that their equipment is in good repair if the required maintenance were costless, the fact that there are costs in time and money weakens the assumption.

It is important that subscribers and service departments of suppliers be able to detect whether the perceived fault is located in the terminal equipment. For household subscribers, such detection requires only the attachment of other terminal equipment to the line or the use of the terminal on a different line - at a neighbour's home, for example. CRTC's interim decision in effect provides such a solution to the detection question and provides for the maintenance of one set by requiring that subscribers obtain at least one telephone (the main telephone) from Bell. Continuation of this requirement would entail costs to subscribers who preferred a telephone which was not available as a first telephone from the telco, or was not available at a competitive charge. The justification for such continued requirement is weak unless it can be demonstrated that the telephone problems that can be perceived by the subscriber or by those whom he has called, cause difficulties for third parties. In that event, failure of some subscribers to arrange for repairs might justify an imposed solution that applied to all subscribers, for identification of poorly maintained sets might be difficult or costly. Taking all factors into account, however, maintaining the requirement that subscribers obtain their first set from the telco is recommended while experience with customer-provided equipment is developed, so long as the first set is a relatively inexpensive piece of equipment, as it is at present. Based on the extension access charge requested by Bell, the cost for the use and servicing of the main telephone is 55 cents per month. Subscribers who might prefer a telephone different in style or function from the one offered, are forced to pay this amount for a set they might not use, or to forego the purchase of the preferred equipment.

Bell and Northern witnesses have explained how changes in the network which affect terminal equipment can proceed much more easily if the telco has end-to-end responsibility. Because the telco operates in a number of exchange areas, it is in a position to transfer terminal equipment easily from an exchange area where changes in network design have made the equipment obsolete. In considering this point, it is necessary to recognize that a change in network design which makes telecommunication terminals obsolete is a rare event - one which requires careful planning and long lead times. If subscribers and terminal equipment suppliers are provided with as much notice as the telco itself has when effecting the necessary changes, it is difficult to see why they should not be able to adjust to changes in network design.

Under TAP, telcos are required to provide a minimum of two years' notice for major changes - a time period considered acceptable by Bell, B.C. Tel and the Director. If customer objections and possible attempts to delay implementation are to be avoided, it is necessary that longer notice be provided by the telco. It is inconceivable that telcos would embark on the changeover of local loops from the analogue to the digital format (or from copper wire to optical fibers) with a planning horizon of two years. A report in the October 27, 1980 issue of *Electronic News* illustrates the long-range planning engaged in by telcos, and specifically by Bell:

> "Bell Canada said it expects by the year 2000 that all of its toll switching operations and 40 per cent of its local switching facilities will be digital.
>
> The Canadian carrier said 36 digital switching systems for different applications are planned for service by year-end and 65 systems are expected to be placed into service by 1984."

The starting date of such a changeover is only one part of the information required by all parties; the schedule of the changeover in specific local exchange areas is also necessary because this information only would permit subscribers to decide whether they should buy or rent equipment, or whether they should seek to sell equipment they already own. The changeover of the complete Bell or B.C. Tel system to local digital transmission will take many years, for the introduction of digital switches is just getting underway. Exchanges with more recent vintage of switches are not likely to be eligible, for some time, for digital technology. It should be possible for telcos to indicate to subscribers in each exchange area whether their terminals will be affected by changes within the telco's planning horizon. Subscribers informed of a change would be in a position to judge whether to purchase rather than rent terminal equipment. The period over which the equipment could be amortized would be one consideration. Another would be the extent to which there was a market for used equipment which would permit the transfer of equipment from one exchange area affected by technical change to another not so affected or, even in the absence of technical change, from one subscriber who, for any of a number of possible reasons, might want to sell his equipment to another.

Another reason for end-to-end control of equipment, if not for ownership, is that this permits the telco to set standards for terminal equipment which take into account the entire cost of the network and not just the perceived advantages of a piece of equipment to the subscriber. One of the examples offered by Bell, in which failure to do this would result in costs which the subscriber would be likely to ignore, is an automatic dialer which follows the instruction to dial a number by seizing a line and dialing without interruption despite a busy signal from the other end. A telco would not purchase automatic dialers which did this; it would specify that the dialer would have to release the line when it received a busy signal and make any subsequent attempts at specified intervals only.

This example and others which could arise during the development of new products highlight the need for equipment standards which are based upon input from telcos as well as others, so that total system costs are taken into account. There is no reason why this function, which is now performed by telcos, could not be easily and inexpensively performed by an independent body, such as DOC, with input from interested parties.

Alternatively, a change in the method of pricing telecommunication services that more adequately reflected the total costs of the system would (as pointed out by Bell in citing the example of the automatic dialer) cause owners of subscriber equipment to pay for heavy use of the system. It is not clear, however, that any existing pricing system based upon usage would resolve this particular problem, for doing so would mean charging subscribers for trying to reach a line already in use. Nevertheless, assuming that customers were well informed of the costs associated with the use of certain convenience features of terminal equipment, as a general principle a system of charges would be preferable to setting standards to protect against heavy use of the system by one set of subscribers, the cost of which would be borne by all subscribers.

While the arguments in favour of end-to-end telco control of all equipment are not compelling, their relative weight would be much greater in an environment in which there was very little differentiation between equipment. When PBXs performed few functions beyond basic switching and all the telephones were one shape and colour, the disadvantages of monopolistic supply were far less important than at present, when offerings of new products laden with features are commonplace. In addition, the competitive spur to cost minimization, absent under monopolistic supply, is probably more important when there is considerable equipment variety and shorter equipment-life cycles which require more frequent reactions and shorter reaction times.

The opportunities created by modern electronics have changed both sides of the market equation: on the supply side, product development and production by relatively smaller and, therefore, more numerous firms than in earlier years is possible;* on the demand side, the product variety made possible by technology is addressing different customer needs. One of the difficulties posed by monopolistic supply by telephone companies is the latter's tendency to standardize on a very small number of competing terminals as a result of the need to train personnel and stock parts throughout their territory.

Equipment offerings in Bell's and B.C. Tel's territories may have been limited by vertical integration as well. That both companies favour the equipment of their related suppliers is not in question. What is not clear, however, is whether this preference results in fewer or substantially different equipment offerings than would otherwise occur because the telcos seek to protect the market position of their related firms.

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* This is not changed by the fact that many of the producers of terminal equipment are owned by great corporations.

A second difficulty with monopolistic supply by a telco is the limited financial alternatives under which the equipment is offered. Competitive markets should be expected to make available a number of lease-and-buy options to suit the differing financial and tax positions of firms. This consideration applies even in an environment in which all equipment is the same.

The ability of a single regulated supplier to perform as well as a competitive market breaks down once there is rapidly changing product variety. This was recognized by Bell in its final argument when it listed the benefits of customer-provided equipment. Its arguments as well as some others are included in the following discussion.

One of the difficulties with regulation is that it takes longer for decisions by the supplier to be implemented. The need for the tariffing of new service offerings means that the introduction of new products is delayed. It is also doubtful whether an unregulated single supplier would introduce products as quickly as they would be introduced in a competitive market, since the single supplier would take into account the existing stock of rental equipment, if rental were one of the options such supplier made available.

Minimization of telecommunication costs by telecommunication users requires that they have access to equipment which best meets their needs. An additional consideration is that the development of telecommunication consulting firms and that of "in-house" expertise are more easily developed when the full range of equipment options is available. Both considerations will grow in importance as the variety of equipment continues to increase.

The features, available on some equipment, that permit users to reduce their long-distance costs - such as call detail recording or route optimization - create a conflict for the telco when it is the supplier of terminal equipment: making the equipment available to users and recommending its use result in a reduction of revenues from services which, according to evidence, provide high net earnings.

The opinion of Bell and of witnesses who would like to see equipment provided by customers is that the cost of terminal equipment to users would fall. Bell, however, does not see this as an advantage because it believes that revenues so lost would result in higher rates for local household services. This aspect of the question is dealt with later. An important question that will probably never be satisfactorily answered, even over a considerable period of time with interconnection in place, is whether prices would fall because of cost efficiencies resulting from competitive supply. Even a cost comparison of "before" and "after" is not strictly possible because there are unlikely to be comparable offerings of equipment and financing. What experience with interconnection should show is whether telcos, through their subsidiaries, are relatively successful providers of terminal equipment in a competitive environment.

Although most of the evidence dealt with terminals for voice traffic, other terminal equipment is affected by the policies of the telcos and CNCP towards customer-provided equipment. Neither the TCTS members nor CNCP permit customers to provide teletypewriters used in the Telex or TWX networks. The reasons advanced are similar to those used for voice terminals: telecommunication companies assume responsibility for end-to-end quality of the traffic because they are operating a network; such operation requires control over the terminal equipment. Presumably the same argument could be raised for any specialized terminals: word processors, facsimile, etc.

In the cases of Telex and TWX, the existence of established protocols means there need be no concern that customers will interconnect equipment that is incompatible with the network. Standards on signal strength and the like may be required, however. Although teletypewriters are at present spare instruments without numerous features, the general arguments in favour of customer-provided equipment apply.

The situation with regard to other types of terminal such as facsimile is different because equipment from the various manufacturers may not be able to communicate. This presents a problem of standards and protocol rather than ownership of terminals, for the telecommunication companies are as free to set protocol without supplying terminals as they are when they do. The problems of attracting customers who own or prefer equipment incompatible with the protocol and standards set, or of communicating with equipment in other countries, exist in either case.

Because monopolistic supply is not justified on balance on technical or economic grounds, there is no basis for continued regulation of the sale or rental of terminal equipment once alternative sources of supply have been created. In the absence of strong grounds for regulation, the objective should be its elimination. The first step towards this goal is an unbundling of terminal rental from the tariffs for transmission services. This step is also crucial in ensuring that market shares are determined by the relative efficiencies of suppliers.

## Loss of Revenue

Bell has filed with CRTC and with this Commission estimates of the loss of revenue resulting from customer-provided equipment. These estimates would be presented and critically examined if it were believed that the decision on interconnection turned on them. It might be noted, however, that the decline associated with charges for extension telephones is the least controversial among the elements accounting for the estimated decline in revenue; it is clear that most of the charge of $2.00 per month to a household for an extension telephone is not required to cover costs associated with the provision of that equipment and its servicing. About one half of the estimated net revenues* of $85 million in 1979 were derived from extension telephones.

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* In point of fact, no provision for the costs of providing and servicing extension telephones was made and all of the revenues were included as net revenues.

While it is possible, with good cost separation procedures, to estimate revenue loss from various assumed inroads on the provision of terminal equipment by telcos, the financial pressure which they will find themselves under in the coming years will depend primarily on the major economic forces affecting price levels, the demand for terminals and the growth of traffic.

Nevertheless, the question about what to do should a loss in revenue occur is one with which the regulator will have to deal. There should be little difficulty, however, in duplicating the present pattern of pricing over the cost of providing extension services and PBX and key system services. Assuming that cost studies permit a determination of what these services yield in net revenues, the regulator can permit the telco to set extension access charges and additional network access charges to make up for revenue losses. Bell's 1980 request to CRTC that households and businesses in larger urban communities pay $1.45 and $2.85, respectively (these particular amounts being examples only), is a demonstration that whether or not a group of subscribers is able to reduce its payments to the telco through the provision of its own equipment depends on regulatory decision. If extension access charges are to be imposed, subscribers who owned their extension telephones must be required to report them to the telco.

Mr. F.E. Ibey suggested that one way to make up for the reduction in net revenue would be to make those who would benefit from interconnection pay for it. Can this be taken to mean that subscribers who choose to provide their own equipment would be charged higher line or trunk charges than those who continued to rent from the telco, assuming that the rental option continued to be available? A preferred interpretation is that the class of subscribers for whom the interconnection option is available should pay access charges at a level which would make up for the loss in revenue resulting from terminal equipment being priced at competitive levels, assuming that a particular level of net revenue is required from a class of subscribers for purposes of cross-subsidization.

Why should an extra charge ever be imposed on subscribers who choose COAM? To say that it is because they benefit is not very helpful unless the environment in which they choose COAM is understood. Consider a situation in which the telco reduces its tariff for equipment rental (and service) to a competitive level. Some subscribers would still choose COAM because of equipment features or because ownership was best from their viewpoint. If a differential charge were to be imposed on such subscribers, the effect would be to reduce COAM in spite of its advantages to them. Only if, for some purpose of public policy, it were required that terminal equipment supplied by the telco be priced above the competitive level, would an additional charge on COAM equipment have to be applied in order for a fair determination to be made of the relative attractiveness of telco-offered equipment on a rental basis and COAM equipment. It is difficult to see why this approach would ever be desirable.

The case of extension telephones is instructive. One of the effects of the CRTC's interim decision was to create a situation which would result in inefficient consumer choice as long as (taking the example of households in large communities) Bell charged $2.00 per extension but was not allowed to impose an extension access charge. Since tariffs for extension telephones have little to do with the costs to Bell of providing a telephone and servicing it (which are, unless stated otherwise, taken to include profits as set by the regulator or those which would be earned, on average, if terminal equipment were unregulated), the effect of COAM without an extension access charge is that COAM is encouraged regardless of how the underlying costs of the option offered by the telco compare with those of COAM. If it is required that extension services continue to subsidize other services, then an equal extension access charge on all subscribers, regardless of whether they rent from the telco or supply their own telephone, would provide unchanged net revenues from this class of service. Assuming that the fifty-five cent reduction in the tariff for extensions correctly measures Bell's long-run unit costs,* the granting of the application for an extension access charge by Bell of $1.45, to be imposed on those who provide their own telephone, would result in the class of subscribers for whom the interconnection option is available being made to pay access charges to make up exactly for the loss in revenue resulting from COAM.

A similar approach could be applied to key systems and PBXs because it is critical that the costs of providing these services be established and reflected in the tariffs. If Bell is correct that these services yield positive net revenues, then it is likely that unchanged tariffs for these services would result in inroads from COAM unrelated to the basic advantages of COAM to subscribers. Setting aside any growth in markets that is likely to occur, net revenues could be expected to decline as the result of any competition-induced reduction in tariffs and reduction in market share.

Because data on telco costs of supplying and servicing subscriber equipment are not available, the implementation of increased access charges could follow only in a more rough-and-ready way than is desirable. It is also possible that telcos may choose not to base their tariffs strictly on costs, because the loss in revenue from increased COAM penetration may be less than the loss in revenue which would result from a reduction in tariffs to a point that it eliminated net revenue. This would be a rational telco response until telcos felt that further penetration was more costly than a reduction in tariffs.

There is only one class of customers who would benefit from COAM but could not be singled out for increased access or extension charges in order to maintain their contribution towards the costs of other services. This class consists of those who rent decorator phones or who have purchased their shells from a telco. It would be unreasonable to try to identify and charge subscribers on the basis of the style of telephone they own.

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* It remains to be seen whether there are significant differences between long-run average and long-run marginal costs.

Bell has stated in final argument that unbundling rates would be costly and unnecessary. In fact, the application for extension access charges would create a form of unbundling - the prices for the separate services (equipment rental and access charges) would be known; the question is whether they should be stated on the bills of those subscribers who have not selected COAM. It is understandable, as a matter of marketing, why Bell or another telco would prefer not to remind the subscriber continually of the COAM option by itemizing the cost to the subscriber of equipment rental and service, but it is difficult to see why it would be costly to do so. It is imperative, having regard to the necessity of unbundling rates, if terminal equipment is to be distributed in a competitive market-place, that buyers have as good information as can reasonably be provided. One item of information that is critical is the present cost of equipment. As long, however, as the telco provides the first telephone as part of its charge for local service (or under usage-sensitive pricing, access to the network) and given that line and trunk tariffs are separated from those for key system and PBX services, there is no other category of voice equipment for which unbundling is required. The access charge for Telex and TWX incorporates the charges for equipment rental and servicing and the COAM option in this area of telecommunication would also require an unbundling of rates.

There is a transitional component and a long-run component to the impact on revenues. The long-run reductions in revenue are those associated with:

a) loss of market share, and
b) lower net revenues resulting from competition-induced pressure on tariffs.

As pointed out earlier, what has here been termed the long-run reduction in revenue can be made up through increasing network access charges if it is desired that the present assumed pattern of cross-subsidization should continue. The transitional component results from the overvaluation of the book value of terminal equipment as the result of regulatory practice associated with the existence of monopoly. Equipment which might have been used for several more years may either be retired earlier or sold for less than its book value. The reductions in book value would result in a reduced rate base, with the impact falling on shareholders' equity.

This matter is currently of concern in the United States as it moves to the detariffing of terminal equipment in response to the FCC decision that terminal equipment should be totally deregulated. In final argument B.C. Tel has stated that liberalization of the attachment of terminal equipment raises a concern about "capital recovery". The impact of changed depreciation requirements is stated to be incorporated in the projections by Bell of the revenue losses that it would experience as the result of COAM. Unfortunately it is not clear how the depreciation factor enters into the Bell projections.

Depending on the scenarios which develop as the result of the decisions taken on COAM and the state of the economy and on the competition which develops, the rates of depreciation used prior to COAM may not harm shareholders. This question, as well as others, can be explored only in the context of specific assumptions about how COAM is introduced and the ways in which telcos supply terminal equipment. These matters are discussed below.

## Telco Participation in Terminal Equipment Supply

Bell established two subsidiaries in 1980 for the marketing of terminal equipment, intelTerm Systems Limited, in February and, in response to the CRTC interim decision on the interconnection of voice terminals, Bell Communications Systems Inc., in September. Both subsidiaries are wholly owned by Tele-Direct Ltd., a Bell subsidiary. The first markets equipment such as word processors and terminal printers for the office environment. Bell Communications Systems Inc. will apparently sell telephones, key systems and PBXs. These moves by Bell highlight the urgency which exists in creating the rules under which Bell and other telcos should be permitted to participate in competitive markets. Before the formation of these subsidiaries, Bell (like many other telcos) was already competing in the sale of mobile telephone equipment, radio-paging services and pagers, and in the rental of some types of data terminals. In long distance transmission of voice and data, competition is restricted to CNCP, on the one hand, and to the members of TCTS in their various operating territories, on the other. Outside of Canada, Bell has addressed the market for international consulting services and has achieved success as part of the consortium which obtained the contract to help modernize the telecommunication system in Saudi Arabia.

The question concerning the conditions under which Bell or any other firm subject to regulatory (rate-of-return) control should participate in competitive markets arises because of the difficulty of separating the costs of providing services offered under monopolistic conditions and goods or services for which there are one or more alternate suppliers. In some cost categories, assignment of costs can be done on an arbitrary basis only. The pressure for Bell and other regulated firms to operate in competitive markets through arm's length subsidiaries arises because of competitors' fears that witting or unwitting subsidization of competitive activities from the revenues of monopolistic activities may occur. There is also a concern that the regulated firm may enjoy certain competitive advantages arising out of its position in regulated markets. The two areas of concern are sometimes based on the same situation. For example, it would be very difficult to assign the costs of billing for equipment rental when such charges are added to a subscriber's bill. It is likely that the additional costs of adding charges for equipment rental are very small. Given that the telco has to bill subscribers regularly in any event, it clearly enjoys some advantage over other firms which wish to engage in equipment rental. Whether this particular advantage or any other is significant will depend on the magnitude of the cost and the average value of sales or rentals. If an arm's length subsidiary were formed for the rental of terminal equipment, one of the conditions which could be required is that the subsidiary do all of its own billing. Thus, one of the ways of eliminating the problem posed by cost separation or the advantage to the telco arising from its regulated activities is to require that the arm's length subsidiary duplicate the function in question. Because this may entail some sacrifice in efficiency, there must be good reasons for requiring such a separation.

A second way of dealing with the problems posed above is to have the telco offer to perform the function or service on the same terms for its subsidiary's competitors as for its subsidiary. The advantage of this approach is that it would avoid duplication of effort while providing a measure of the relative efficiency of the subsidiary exclusive of the activity in question; competitors would not be placed at a disadvantage even though no accurate cost separation is feasible. This approach can be especially useful in contexts where transmission or switching services are provided. For example: to the extent that the facilities provided to radio paging companies for NNX codes or for long distance transmission of paging signals are the same as those used by a telco's paging division or subsidiary, the charges should be the same. In this approach, it makes no difference whether a division or a subsidiary performs the competitive activities; what matters is tight accounting. A subsidiary is required, however, where it is desirable to have the organization serving the competitive market not rely on the parent for functions or services other than financing and certain top management direction.

Debt and equity capital for financing entry into the competitive sale of terminal equipment can be raised at an apparently lower rate by the regulated firm than they could be raised by even the strongest corporations. The reason why the lower rate is only apparent is because the venture into competitive activities is likely to entail risks that will affect the costs of capital of the telco, but it will be very difficult to measure this effect, particularly while the competitive activities form a small part of the telco's total activities. This can be dealt with in a fashion by the telco or its regulator setting an acceptable rate of return on the capital invested in the competitive activities. An approach similar to this was adopted by the CRTC in dealing with the question of the price paid by B.C. Tel for the Canadian assets of Automatic Electric. A rate of return above or below that set by the regulator can then affect the net return of the telcos' shareholders according to some preset formula. This approach has the unacceptable effect of widening the area of regulation. An alternative approach which can easily be accomplished if an arm's length subsidiary is established is to allow all net returns to impact on the earnings of the telcos' shareholders; that is, to allow the earnings from competitive activities to be separated from the activities subject to regulation. The advantage of this treatment of earnings is that there is greater deregulation and management becomes more directly answerable to shareholders. Fairness to subscribers, however, requires that the earnings from competitive activities not be based to any important extent on the telcos' regulated activities. An example is provided by Bell's Saudi Arabian contract which depends completely on the expertise acquired by Bell in providing regulated services. Whether some flow-through of earnings to shareholders outside the regulated stream is desirable as an incentive to Bell to seek such business is a separate matter.

It is probably impossible to prevent a telco from using its borrowing power to finance its competitive activities, even if the subsidiary is in an arm's length relationship. In effect, the telco uses all its sources of capital-equity, debt, cash flow - to finance the purchase of shares of the subsidiary and this gives the subsidiary indirect access to the borrowing power of the telco. This cannot be avoided so long as ownership of the new marketing organization resides with the telco. For example, reliance on B.C. Tel financing would exist if an interconnect company were set up by B.C. Tel, but not if it were owned by GTE or by Anglo-Canadian, the holding company through which GTE holds a majority of B.C. Tel's shares. In the case of Bell, the advantage to the subsidiary would not appear to be of sufficient importance to consider a restructuring of the corporate structure so that ownership of the subsidiaries engaged in competitive activities rested with a holding company instead of with the operating telco.

Bell and other telcos which wish to sell or rent terminal equipment should be required to do so through an arm's length subsidiary. The subsidiary should operate with its own managerial, marketing, servicing and accounting resources. During a specified period of transition, the telco would thus continue to lease equipment under tariff and the revenues and costs associated with this activity would be used in determining its revenue requirements. In addition, the telco would be free to sell or rent equipment through an arm's length subsidiary whose activities, costs and revenues would fall outside regulation. Placing the subsidiary at arm's length would serve the very important purpose of signaling to would-be competitors that there is no danger of predatory pricing. Such assurance would be likely to hasten decisions to invest in facilities for selling, distributing and servicing equipment and thus lead more quickly to the development of a competitive supply of terminal equipment. A related advantage that would be likely to arise is a reduced need for the intervention of the telcos' regulators, a result that would occur if it were clear that no cross-subsidization of competitive activities from monopolistic activities was occurring.

A considerable marketing advantage enjoyed by the telco over any of its competitors is its knowledge of the length of two-tier contracts and the type and capacity of equipment used by subscribers. It is conceivable that strict rules on arm's length dealing could prevent its transfer to a subsidiary or to a division of the telco. The important point about information of this kind, however, is that it should be made available on the same terms to all suppliers. It should be a straightforward task for the telco to prepare schedules showing the identity of the subscriber, the type of equipment and its capacity, and the expiration date of two-tier contracts for all business and other non-household subscribers in each geographic area.

The transition period should be designed to allow the telcos and their customers the opportunity to adjust to the deregulation of the distribution of terminal equipment. Under deregulation, it is doubtful that many subscribers would choose to rent telephones because of the cost of renting an item with such a small capital value. Subscribers must be allowed time to become accustomed to ownership rather than rental, a process that will occur as sales outlets for telephones become widespread. A period of adjustment, however, is required by telcos mainly to allow them to depreciate their existing stock of terminal equipment and to adjust their future purchases of terminal equipment and their marketing efforts so that they will not be left with an embarrassing stock of undepreciated equipment when detariffing takes place. A period of the order of 10 years should allow the telcos ample time to make the necessary adjustments. The precise period is not important. What matters is that a firm date should be set so that a time framework for planning will exist, and that the period be long enough so that existing terminal equipment will be depreciated or sold. This period should easily allow for the entry of a number of terminal equipment vendors and for the adjustment of subscribers to the new market situation.

The CRTC's interim decision that Bell should provide the first telephone as an integral part of a subscriber's access to the network is likely to come under attack as an unnecessary cost as subscribers avail themselves of the increasing variety of shapes, colours and instruments which can perform functions in addition to those of a traditional telephone. A trend away from the telco as the supplier of the first telephone is only possible if the requirement is modified so that it is not universally applicable. For instance, all new subscribers could be required to supply their own first telephone and thereby receive a reduction from their monthly telephone bill of the estimated cost to the telco of providing the instrument and servicing it. An alternative method of phasing in customer ownership of the first telephone is by exchange area, ownership being first introduced in those areas where a move to digital transmission is least likely. In any event, it would be reasonable to require subscribers to purchase their main telephone from the telco when detariffing occurred.

At present, Bell sells telephones through its telephone outlets under tariffs filed with CRTC. It is noteworthy, however, that Bell's advertisements in the Ottawa newspaper showed prices below the filed tariffs, and that even these lower prices were considerably above those advertised by a food chain. Bell has contended in final argument that it is unreasonable to expect it to file tariffs for goods or services offered in competition against those of unregulated rivals. This position is undoubtedly correct but leaves the telcos' outlets in an anomalous position, since as sales outlets they should be operated separately from Bell's regulated activities. The telephone outlets, however, also serve the function of providing extension and first telephones under tariffed rental. The costs of selling telephones on an unregulated basis and the costs of renting and servicing telephones under regulation would probably both be higher if the two sets of activities had to be provided from separate establishments. Concern for subscribers' interests suggests that an exception be made in this event to the general position that competitive activities be available only through arm's length subsidiaries. Such a decision should only be made by the regulator after it receives cost information that indicates the magnitude of the cost penalty that would be incurred as a result of separation. It would also be wise not to exaggerate the dangers of cross-subsidization from regulated activities. Although retailing raises the difficult problem of joint-costs, it is also true that it is easy to calculate the markup on a single instrument such as a telephone and thus to determine whether it is being sold below cost on a sustained basis. If the telcos' outlets are to perform the dual role described, it is important that they not be permitted to enlarge the range of equipment they offer to include key telephones and small PBXs.

The problem of placing a valuation on the telephone outlets would arise, however, when detariffing of the first telephone and of extensions occurred, for they would no longer be required in the provision of regulated activities. It would then be reasonable to sell the outlets either singly or together to the arm's length subsidiary or to other interested buyers. The possibility of other buyers would have to be considered if the arm's length subsidiary were not prepared to pay the value established by independent consultants retained under the authority of the regulator.

A press release issued by Mr. G.E. Inns, Executive Vice-President (Ontario Region), Bell Canada, following CRTC's interim decision, stated that Bell stood ready to accept offers for its equipment in place and the associated inside wiring. The issues raised by this statement are different for inside wiring than for KTSs and PBXs. Although it may be difficult to establish a reasonable market value for both the inside wiring and the second-hand subscriber equipment, the difficulty with allowing the sale of this equipment is that such sales would have an adverse effect on interconnect vendors if the prices set were not fair or reasonable. The same kind of danger does not exist in the case of inside wiring and there is no apparent reason why Bell should be prevented from arranging for the sale of the inside wiring used with subscriber equipment when a subscriber chooses to stop renting equipment from Bell.

The difficulty with Bell's selling its used "subscriber equipment" is that its value is unknown. This difficulty will exist regardless of whether Bell itself sells the equipment or a subsidiary makes the sale. Certainly its book value is unlikely to be a good indicator of its value. On the one hand, the rate of depreciation established for regulatory purposes is probably lower than would be used if the equipment were rented in a competitive environment. On the other hand, no allowance is made for the increasing value of the equipment as the result of inflation. Moreover, what might be termed the "fair market value" of the equipment will vary with the circumstances under which it is sold: to individual customers when they want to buy or rent a competitor's equipment; bulk sale in an effort to exit from the equipment rental business; a widely publicized policy to sell the equipment to individual customers in preference to renting it. If an attempt to sell the equipment is made only when customers express an interest in changing to another supplier, the danger exists that Bell will set any price which is necessary to assure that the customer purchases the Bell equipment in place. Given the differences in equipment vintages and configurations, price comparisons between sales to different customers will be difficult.

It may be in some customers' interest to purchase Bell's equipment because it is already in place, rather than buy a new system. Bell's costs of installation are bygones; its recovery of any part of them would represent a net gain. In addition, since the equipment is in place, it may have a greater value to the subscriber than to other potential buyers. These potential benefits suggest it would be wise to let Bell proceed with the sale of equipment in place even though failure to develop an acceptable method of evaluating it could result in harm to some interconnect suppliers. Bell itself will need some experience before it knows what the equipment is worth. It is important that the failure of some interconnect vendors to complete sales not automatically be taken to mean that Bell's sales of used equipment involve predatory intent or effect. Given market growth, the advances in new equipment, and Bell's interest in maintaining the value of its asset base and not encouraging the belief in the minds of subscribers that it is cheaper to buy than to rent, it is doubtful whether significant harm is likely to come to interconnect vendors from the sale of equipment in place by Bell. In addition, there is no problem in Bell's selling whatever equipment becomes surplus to its needs to any interested firms as long as no preferential opportunity to do so is given to its arm's length subsidiary or any other buyer.

## Mergers and Exclusive Dealing

If eventual deregulation of terminal equipment is accepted, the task is to change the condition of supply from monopoly to competition. One of the ways of ensuring competitive supply is to safeguard against predatory behaviour, a matter already dealt with. Other possible threats to competition have been raised by the Director in final argument: mergers which eliminate competitors of Bell or Northern and exclusive arrangements between Bell and suppliers that exclude interconnect vendors from access to certain equipment. The Director has requested that the RTPC recommend that an order of prohibition be sought by the Director preventing mergers or exclusive dealing by Bell or Northern which would have effects cited above. Bell and Northern have objected to the seeking of an order against hypothetical future behaviour on their part.

There are two possible merger situations that fall into the area of concern raised by the Director. The first is the acquisition of a major Canadian manufacturer of terminal equipment that is in competition with Northern. For instance, let us assume that Bell or Northern sought to acquire Mitel. This acquisition would eliminate a competitor of Northern that is now a supplier of PBXs in the smaller size range and is developing larger ones. Apart from the immediate impact that this acquisition could have on consumer choice, it could have long-run negative effects on Canada as a supplier of telecommunication equipment: the fresh approach that was open to Northern following the closing of access to Western Electric's technology is very much evident in Mitel's rapid product development and marketing success. It is of critical importance that independent management styles be maintained.

Acquisition by Bell or Northern of interconnect firms is the second kind of situation that would almost certainly be unacceptable. The major reason for allowing Bell or other telcos to enter into the competitive supply of terminals is that the history of their involvement in terminal supply creates the promise that they will be efficient suppliers. Because of the difficulties associated with regulated firms operating in competitive markets, the policy concern created when such operation requires the support of the acquisition of such firms' competitors would increase the apprehensions of policy-makers.

Exclusive dealing raises issues which in the case of an operating telephone company are very different from those which arise in the case of a telephone company's subsidiary. While detariffing is proceeding, the telco will almost certainly continue to be the major purchaser of equipment. It would be unacceptable for the telco, through the use of its purchasing power, to become an exclusive distributor of equipment. For the telco to win exclusive rights for its subsidiary would also be a flagrant abuse of its position.

Whether exclusive dealing arrangements entered into by the telco's subsidiary or by other distributors would create a problem for competition cannot yet be determined; some time must be allowed for the development of an understanding of the interconnect industry. The evidence on the U.S. interconnect industry indicates that exclusive agreements and vertical integration from manufacturer to distributor are not uncommon. Very little is known, however, about the reasons for the observed structure and practices in the industry.

## Eligible Suppliers

One of the major arguments raised by Bell and Northern against interconnection is the impact they predict it will have on domestic output and employment. The facts and arguments which have been consistently pursued throughout the inquiry may be summarized as follows:

1) The telecommunication equipment industry is characterized by large multinational companies.

2) These companies operate from bases in protected home markets.

3) Telecommunications is a success relative to other Canadian manufacturing industries, particularly those in electronics, in international trade terms.

4) This success is based on Canadian ownership and vertical integration which have prevented fragmentation of the industry by:

   a) providing non-tariff barriers which prevent imports,
   b) discouraging the creation of a number of separate firms,
   c) encouraging domestic R&D because there are no head office restrictions on exports such as might obtain in the case of branch plants.

5) Interconnection will encourage imports and a branch plant economy which will create conditions common to a number of Canadian industries.

Bell and Northern argue that Northern should remain the preferred supplier of Bell telecommunication equipment almost in the sense that Spar is the sole Canadian supplier of satellite equipment to Telesat and particular manufacturers are given preferred status in a number of countries.

A related and less categorical position is that it would be damaging and unfair to Canadian suppliers to permit foreign-based firms to supply terminal equipment to the Canadian market when the home markets of these firms are closed to Canadian firms. This argument has found expression in the appeal to Cabinet by Bell and the Ontario Government requesting that the CRTC interim decision be modified so that the Canadian market would not be open to foreign suppliers unless they were based in countries which allowed access to Canadian firms. The principle of reciprocity, it will be recalled from Chapter V, was expressed in DOC papers in the early 1970s.

The question of "industrial strategy" is a broad one and the evidence to permit judgment on one version or another is not available in this inquiry. The issue of how best to proceed with telecommunication terminal equipment must be considered in relation to the conditions in that industry. One of the essential considerations is that monopolistic supply does not yield an adequate range of consumer choice. The costs of limited equipment choice in the case of non-household users results in higher costs of operation. While it is difficult to measure the impact on household subscribers, it is no less real. There is no reason to believe that constraints on minimizing telecommunication costs are any less damaging to enterprises in Canada than they would be in any other area of an enterprise's operations. The central issue in interconnection must be considered as well in arriving at strategies for developing Canadian industry. If limits on consumer choice are considered appropriate in Canadian industry as a means of achieving economies of scale, there are many products where choice is less important. Moreover, equipment variety is likely to increase with the continued application of electronics which is resulting in the breakdown of product definitions and the merging of voice and data equipment.

The decision to develop a preferred supplier for the Government (or one of its agencies) raises very different issues. Satellites and the case of Spar provide a useful illustration. The question of product choice does not arise, for design is in the hands of the buyer. The issue is essentially one of costs. A second point of some importance is that government support of Spar is intended to be of limited duration according to the testimony of Mr. L.D. Clarke, Chairman of the Board and Chief Executive Officer, Spar Aerospace Limited. Such a policy is consistent with the classic infant industry argument in economics: support or protection may be appropriate for a limited time until the industry develops. In terminal equipment, the largest firms in Canada, Northern and Microtel, are highly developed and are major suppliers in North America. Although Mitel has been a producer of PBXs since the mid-70s only, it is a highly successful innovator. Furthermore, it has been the beneficiary of large government aid for plant expansion.

Nevertheless, interconnection will create fragmentation of the Canadian market. How far it proceeds and how damaging it becomes will depend in large measure on the number of firms selling in Canada and on the market opportunitites available to Canadian firms outside the country. From the point of view of fairness there is no justification for allowing firms to supply the Canadian market if their home market is not open to Canadian firms. Moreover, if a policy of reciprocity were feasible it would provide a useful bargaining counter in trade negotiations. Above all, it would more likely provide to Canadian firms the opportunity to sell in foreign markets. Depending on the success of Canadian firms, this would more or less offset the loss of sales in Canada to foreign firms.

Unfortunately, the evidence before the Commission suggests that such a policy is not realizable under GATT rules. Mr. G. Elliot, Director General, Office of General Trade Relations of the Department of Industry, Trade and Commerce, testified that obligations under GATT restrict the ability of signatory governments to pursue reciprocity. Mr. Elliot made specific reference to the Agreement on Technical Barriers to Trade passed in furtherance of GATT which provides that technical regulations and standards not be discriminatory and not be set up in such a way as to create obstacles to international trade. He explained that if the Canadian Government were to set standards for COAM equipment, goods originating in particular GATT countries would have to have equal access to certification procedures as Canadian goods. The essence of the Technical Barriers Code is that domestic regulations affecting the sale of goods within a signatory country should be non-discriminatory and should apply equally to foreign goods and locally produced goods. The most-favoured-nation principle makes reciprocity even less defensible than policies restricting supply to local suppliers. The concluding part of section 1 of Article I of GATT states clearly: ". . . any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties."

It is also true that imports could not be restricted to goods whose home market is open to Canadian telecommunication products. Country of origin, with some exceptions for content, generally determines the nationality of a product for tariff purposes. Thus, the exports from a branch plant in the U.S. of a firm such as Dumont-Schneider, whose ownership and primary operations are in France, would be treated as exports from a U.S. company. The extension of this principle would give access to the Canadian market to the many non-U.S.-home-based firms who manufacture in the U.S.

With the recent notable exception of Japan, government procurement of telecommunication products is not included under GATT. Nor do GATT obligations apply to subsidiary levels of government. The carriers in the U.K. and the rest of Europe (and, until recently, Japan), which are generally government authorities, support local suppliers in their carrier procurement programs. Significantly, these countries also, through the requirement set by the carriers that their approval must be obtained for equipment to be attached to the network, support local manufacturers in the privately supplied interconnection market. In several countries local content is quite openly required. In other countries, the U.K. for example, it is actively encouraged. Recently the U.K. has announced a policy of reciprocity whereby non-local suppliers can compete in the interconnect market, but only if the supplier is from a country which does not discriminate against British telecommunication equipment. Mr. Elliot noted that it is not clear what the U.K. authorities have in mind or how they will achieve their objective in the context of GATT. The Department of Industry, Trade and Commerce is seeking information on the precise practices in other interconnect markets following CRTC's interim decision.

Interconnect suppliers from a number of countries whose markets are not open to Canadian firms, are now selling their equipment in Canada. It is urgent that it be determined whether these countries have adopted policies or set up technical barriers resulting in the closure of their markets to Canadian firms in contravention of the international obligations assumed under GATT.

Vice-Chairman

Member

Member

Ottawa

September 10, 1981

# APPENDIX A

## HEARINGS

### 1. Pre-hearing

Ottawa, June 15, 1977

| | |
|---|---|
| Mr. T.G. Kane<br>Mrs. S. Magnet | Consumers' Association of Canada |
| Mr. M. Rabin | CN Telecommunications |
| Mr. K. Rubin | Coordinator<br>Action Bell Canada |
| Mr. G.F. Henderson, Q.C.<br>Mr. G.E. Kaiser | Counsel for the Director of Investigation and Research |
| Mr. D.W. Burtnick, Q.C.<br>Mr. D.W. Duncan, Q.C. | For the Government of the Province of Ontario |
| Mr. L. Bilodeau<br>Mr. F. Paradis<br>Miss C. Samuel<br>Mr. R. Mainville<br>Mr. M. Ruel | For the Government of the Province of Quebec |
| Mr. W.J. Simpson | Canadian Cable Television Association |
| Mr. P.W. Butler | British Columbia Telephone Company, and<br>Okanagan Telephone Company |
| Mr. G.M. Smith | British Columbia Telephone Company |

### Ottawa, June 15, 1977 (cont'd.)

| | |
|---|---|
| Mr. P. Genest, Q.C. | Northern Telecom Limited |
| Mr. J.T. DesBrisay, Q.C. | |
| Mr. C.V. Allen | |
| Mr. L. Berger | |
| Mr. A.J. MacIntosh, Q.C. | Bell Canada |
| Mr. J.W. Brown, Q.C. | |
| Mr. W.D. Grover, Q.C. | |
| Mr. D.C. Ross | |
| Mr. G. Houle | |
| Mr. R. Marchand | |

## 2. Arguments on Interconnection

### Ottawa, October 13, 1977

| | |
|---|---|
| Mr. A.J. MacIntosh, Q.C. | Bell Canada |
| Mr. K.D.A. Morrison | British Columbia Telephone Company |
| Mr. J.T. DesBrisay, Q.C. | Northern Telecom Limited |
| Mr. D.W. Burtnick, Q.C. | Government of the Province of Ontario |
| Mr. L. Bilodeau | Government of the Province of Quebec |
| Mr. G.F. Henderson, Q.C. | For the Director of Investigation and Research |

### Ottawa, September 23, 24, 25 and 26, 1980 and October 16 and 17, 1980

| | |
|---|---|
| Mr. G.F. Henderson, Q.C.<br>Mr. G.E. Kaiser | For the Director of Investigation and Research |
| Mr. A.J. MacIntosh, Q.C. | Bell Canada |
| Mr. W.D. Grover, Q.C. | |
| Mr. J.T. DesBrisay, Q.C. | Northern Telecom Limited |
| Mr. D.W. Burtnick, Q.C. | Government of the Province of Ontario |

## WITNESSES

Vancouver, September 19, 20, 21 and 22, 1977

| | |
|---|---|
| Mr. H.J. Page | Director<br>Communications Systems Development and Regulations Branch<br>Communications Services<br>Ministry of Energy, Transport and Communications of British Columbia |
| Dr. W.H. Melody | Professor and Chairman<br>Department of Communication Studies<br>Simon Fraser University |
| Dr. D.W. Smythe | Professor<br>Department of Communication Studies<br>Simon Fraser University |
| Mr. H. Kay | Vice-President<br>Research Industries Limited |
| Mr. G.F. MacFarlane | Chairman of the Board and Chief Executive Officer<br>British Columbia Telephone Company |
| Mr. J.C. Carlile | Vice-President, Operations<br>British Columbia Telephone Company |
| Mr. D.B. McNeil | Vice-President, Supplies, Transportation and Buildings<br>British Columbia Telephone Company |
| Mr. D.M. Carter | Chief Engineer<br>British Columbia Telephone Company |

Vancouver, September 19, 20, 21 and 22, 1977 (cont'd.)

| | |
|---|---|
| Mr. J.R. Peillard | Dominion Customs Appraiser<br>Customs and Excise Division<br>Department of National Revenue<br>Ottawa |
| Mr. W.C. Short | President<br>Independent Telephone Technical Agencies, Inc. |
| Mr. K. Deering | Manager<br>Glenayre Electronics Ltd. |
| Mr. J.H.S. Campbell | President<br>Consultec Canada Limited |
| Mr. W.D. Messer | President<br>Distacom Communications Limited |

Edmonton, September 27 and 28, 1977

| | |
|---|---|
| Mr. S.J. Armstrong | Director of Purchasing<br>'edmonton telephones' |
| Mr. A.S. Baptie | Manager, Organization Development and Financial Results<br>'edmonton telephones' |
| Mr. G.K. Foster | General Manager<br>'edmonton telephones' |
| Mr. R.G. Ades | President<br>Alberta Government Telephones<br>- (no appearance - brief read into the record) |
| Mr. H.W. Jamieson | Marketing Manager<br>Palco Electronic Manufacturing and Supplies Ltd. |

## Edmonton, September 27 and 28, 1977 (cont'd.)

| | |
|---|---|
| Mr. C. Cousineau | Business Intervenors Society<br>Edmonton |
| Mr. J.M. Green | Partner<br>Green, Michaels and Associates Ltd. |
| Mr. G.C. Reid | General Manager<br>Allied Communications Limited |

## Toronto, October 4, 5, 6 and 7, 1977

| | |
|---|---|
| Mr. J.E.H. Elvidge | Assistant General Manager<br>Marketing<br>Raytheon Canada Limited |
| Mr. B. Mather | Federal Chairman<br>Canadian Federation of Communications Workers |
| Mr. R.W. Walker | Manager, Special Products<br>Marsland Engineering Limited |
| Mr. J.E. Nobes | Comptroller<br>Marsland Engineering Limited |
| Mr. G.G. Cooper | President<br>Intertel Limited |
| Mr. R.W. Walton | President<br>The Dictograph Corporation Ltd.<br>- former General Manager<br>Harding Communications Limited |
| Mr. R.B. Barnard | General Manager<br>The Aylmer and Malahide Telephone Company Limited<br>- (now "Amtelecom Inc.") |

## Toronto, October 4, 5, 6 and 7, 1977 (cont'd.)

| | |
|---|---|
| Mr. G.W. Parsons | President<br>Cybercom Inc. |
| Mr. C.G. Webster | Chief Engineer<br>Telecommunications Division<br>Canadian National Railway |
| Mr. I.H. Nixon | President<br>Tele-Radio Systems Ltd. |
| Mr. H. McLafferty | Co-owner<br>Primal Communications Ltd. |
| Mr. I.G. Kaye | President<br>Telepulse Corporation Limited |
| Mr. P.T. Wilson | Manager<br>Reliable Communication & Power Products Ltd. |

## Halifax, October 18, 19 and 20, 1977

| | |
|---|---|
| Mr. S. Robertson | President<br>Maritime Telegraph and Telephone Company, Limited |

## Fredericton, October 25, 26 and 27, 1977

| | |
|---|---|
| Mr. W.J. Gillis | Electronic Industries Limited |
| Mr. E.A. Belliveau | President<br>Altron Electronics Ltd. |
| Mr. A.F. Angerer | Sturgeon Bay<br>Wisconsin, U.S.A.<br>- (no appearance - letter read into the record) |

### Fredericton, October 25, 26 and 27, 1977 (cont'd.)

| | |
|---|---|
| Mr. G.E. Graham | Vice-President, Planning<br>The New Brunswick Telephone Company, Limited |
| Mr. E.D. Thompson | President<br>TransCanada Telephone System |

### Montreal, November 7, 8, 9 and 10, 1977

| | |
|---|---|
| Mr. A.J. de Grandpré, Q.C. | Chairman of the Board and Chief Executive Officer<br>Bell Canada |
| Mr. E.J. Keane | Vice-President and General Manager<br>Vidar<br>A Division of TRW Inc. |
| Dr. Gar Lam Yip | Associate Professor<br>Department of Electrical Engineering<br>McGill University |
| Dr. M.R. Irwin | Professor of Economics<br>The Whittemore School of Business and Economics<br>University of New Hampshire |

### Winnipeg, November 22, 1977

| | |
|---|---|
| Mr. G.W. Holland | Chairman and General Manager<br>Manitoba Telephone System |
| Mr. S.G. Anderson | Vice-Chairman and Assistant General Manager<br>Manitoba Telephone System |
| Mr. S.L. Wilson, Jr. | President<br>Quality Communication Products Ltd. |

## Winnipeg, November 22, 1977 (cont'd.)

| | |
|---|---|
| Mr. K.R. Yates | President<br>A.E.I. Telecommunications (Canada) Limited |
| Mr. J. Rudnick | President<br>Cook Electric Company of Canada Ltd. |

## Regina, November 24, 1977

| | |
|---|---|
| Mr. G. Taylor | For the Attorney General of Saskatchewan |
| Mr. R.G. Mickleborough | Eston, Saskatchewan |
| Mr. N.C. Hill | Secretary-Treasurer<br>Develcon Electronics Ltd. |
| Mr. D.W. Johnson | Vice-President<br>Engineering<br>SED Systems Ltd. |
| Mr. G.D. McCormick | General Manager, Saskatchewan Telecommunications - (no appearance - brief read into the record) |

## Toronto, December 12, 13, 14, 15 and 16, 1977

| | |
|---|---|
| Mr. G.G. Murray | Chairman<br>Data Processing Group<br>Canadian Business Equipment Manufacturers Association Inc. (CBEMA) - and<br>Vice-President, General Counsel and Secretary<br>IBM Canada Ltd. |

Toronto, December 12, 13, 14, 15 and 16, 1977 (cont'd.)

| | |
|---|---|
| Mr. R.F.C. Morris | Chairman<br>Office Machine Group<br>Canadian Business Equipment Manufacturers Association Inc. (CBEMA) - and<br>President<br>Dictaphone Canada Ltd. |
| Mr. P.J. Suddick | Director<br>Canadian Business Equipment Manufacturers Association Inc. (CBEMA) - and<br>Vice-President and Director<br>Honeywell Limited |
| Mr. W.G. Glover | Director<br>Canadian Business Equipment Manufacturers Association Inc. (CBEMA) - and<br>Senior Vice-President<br>Systems and Services Division<br>Control Data Canada Ltd. |
| Mr. K.C. Lees | Director<br>Canadian Business Equipment Manufacturers Association Inc. (CBEMA) - and<br>Telecommunications Advisor<br>IBM Canada Ltd. |
| Mr. M. Carley | President<br>Yellow Directory |
| Mr. A.R. Monk | General Manager<br>The Telephone Store Limited |
| Mr. P.A. Noakes | Vice-President and General Manager<br>Canadian Motorola Electronics Company, A Division of Motorola Electronics Sales Limited |

### Toronto, December 12, 13, 14, 15 and 16, 1977 (cont'd.)

| | |
|---|---|
| Mr. S.T. Luck | Owner and Manager<br>Sid Luck Enterprises |
| Mr. R. Bom | Chairman of the Board<br>and President<br>Philips Electronics Ltd. |
| Mr. F.H. Hamer, Q.C. | Vice-President, General<br>Counsel and Secretary<br>Philips Electronics Ltd. |
| Mr. J.H. McIvor | President<br>Telcost Limited |
| Mr. P.G. Ouellette | Vice-President<br>Telcost Limited |
| Mr. R.J. Mayes | Merchandising Manager<br>Canadian Operations<br>Radio Shack, A Division of<br>Tandy Electronics Limited |
| Mr. G. Waldeck | Staff Engineer<br>Radio Shack, A Division of<br>Tandy Electronics Limited |
| Mr. C.G. Webster | Chief Engineer<br>Telecommunications Division<br>Canadian National Railway |

### Ottawa, January 16, 17 18 and 19, 1978

| | |
|---|---|
| Dr. M.C.J. Cowpland | President<br>Mitel Corporation |
| Mr. A.M. Marshall | President<br>Technex International Ltd. |
| Mr. J.H. Stevens | Chairman of the Board and<br>Chief Executive Officer<br>Canada Wire and Cable Limited |

Ottawa, January 16, 17, 18 and 19, 1978 (cont'd.)

| | |
|---|---|
| Mr. J.L. Olsen | President and Chief Executive Officer<br>Phillips Cables Limited |
| Mr. J. Kruppa | General Manager<br>Electronics<br>Siemens Electric Limited |
| Mr. W. Andresen | Marketing Manager<br>Communication Systems<br>Siemens Electric Limited |
| Mr. J.F. Edbrooke | Vice-President<br>Engineering<br>LM Ericsson Limited |

Ottawa, January 23, 24, 25, 26 and 27, 1978

| | |
|---|---|
| Mr. E.B. Spievack | General Counsel<br>North American Telephone Association |
| Mr. C.C.W. Box-Grainger | Group Telecommunications Manager, Group Marketing Manager and Chief Consultant<br>Telephone Rentals Limited group of companies<br>(United Kingdom) |
| Mr. R.C. Chaston | President and General Manager<br>York Cablevision Limited<br>- Member of the Canadian Cable Television Association |
| Mr. O. Girard | President<br>Transvision Magog Inc.<br>- Member of the Canadian Cable Television Association |

### Ottawa, January 23, 24, 25, 26 and 27, 1978 (cont'd.)

| | |
|---|---|
| Mr. K.E. Hancock | Director<br>Engineering<br>Canadian Cable Television Association |
| Mr. W.J. Simpson | President<br>W.J. Simpson Consultants Ltd. - Member of the Canadian Cable Television Association |

### Ottawa, January 30 and 31, 1978

| | |
|---|---|
| Mr. F.R. Lamb | General Manager<br>Wescom Canada Limited |
| Mr. J. Kruppa | General Manager<br>Electronics<br>Siemens Electric Limited |
| Mr. W. Andresen | Marketing Manager<br>Communication Systems<br>Siemens Electric Limited |

### Ottawa, February 1, 2 and 3, 1978

| | |
|---|---|
| Mr. J.F. Edbrooke | Vice-President<br>Engineering<br>LM Ericsson Limited |
| Mr. E. Carnell | President<br>LM Ericsson Limited |
| Mr. A.M. Marshall | President<br>Technex International Ltd. |
| Dr. M.R. Irwin | Professor of Economics<br>The Whittemore School of Business and Economics<br>University of New Hampshire |

### Ottawa, February 1, 2 and 3, 1978 (cont'd.)

| | |
|---|---|
| Mr. B.E. Ruscoe | Vice-President<br>Sales and Marketing<br>Mirtone Industries Ltd.<br>- (no appearance - letter read into the record) |

### Edmonton, March 6, 7 and 8, 1978

| | |
|---|---|
| Mr. H.W. Jamieson | Marketing Manager<br>Palco Electronic Manufacturing and Supplies Ltd. |
| Mr. G.K. Foster | General Manager<br>'edmonton telephones' |
| Mr. A.S. Baptie | Manager, Organization Development and Financial Results<br>'edmonton telephones' |
| Mr. K.R. Yates | President<br>A.E.I. Telecommunications (Canada) Limited |
| Mr. E.H. Hulbert | Supervisor<br>South Alberta Subscribers<br>Alberta Government Telephones<br>- Subpoena in his personal capacity |
| Mr. R.J. Barnes | President<br>Bartronics (1972) Limited |
| Mr. J.M. Green | Partner<br>Green, Michaels and Associates Ltd. |
| Mr. J.T. Bryson | President<br>Tell A Phone Systems Inc. |

## Vancouver, March 14, 15, 16 and 17, 1978

| | |
|---|---|
| Mr. D.B. McNeil | Vice-President, Administration<br>British Columbia Telephone Company |
| Mr. J.C. Carlile | Vice-President, Operations<br>British Columbia Telephone Company |
| Mr. D.M. Carter | Chief Engineer<br>British Columbia Telephone Company |
| Mr. G.A. Poch | Group Legal Counsel<br>North America Telecommunications<br>International Telephone and Telegraph Corporation |
| Mr. K. Cameron | President and General Manager<br>Communications Division<br>ITT Industries of Canada Limited |
| Mr. W. Wilkerson | Vice-President and Director of Corporate Relations and Advertising<br>ITT Canada Limited |
| Mr. D. Lucas | Director of Sales<br>ITT Canada Limited |
| Mr. F.P. Barnes | Senior Vice-President and Group Product Manager<br>Telecommunications Products and Systems Worldwide<br>International Telephone and Telegraph Corporation |
| Mr. E.J. Keane | Vice-President and General Manager<br>Vidar<br>A Division of TRW Inc. |

## Vancouver, March 14, 15, 16 and 17, 1978 (cont'd.)

| | |
|---|---|
| Mr. F. Toy | Chairman<br>Canadian Airlines Telecommunications Association<br>- and Director<br>Radio Communications<br>Pacific Western Airlines Ltd. |
| Mr. W.G. Clark | Business Agent<br>Plant Division<br>Telecommunications Workers Union, B.C. |
| Mr. N.W. Youngs | Business Agent<br>Plant Division<br>Telecommunications Workers Union, B.C. |
| Dr. W.H. Melody | Professor and Chairman<br>Department of Communication Studies<br>Simon Fraser University |
| Dr. D.W. Smythe | Professor<br>Department of Communication Studies<br>Simon Fraser University |
| Mr. H.A. Metzger | President<br>Bertus Industrial Limited |
| Mr. M. Mahony | President<br>Cardinal Communications Ltd. |

## Montreal, April 3, 4, 5 and 6, 1978

| | |
|---|---|
| Mr. S.H. Franke | President<br>Plantronics Canada Limited |
| Mr. D.J. Hadley | President<br>Farinon Canada Limited |

### Montreal, April 3, 4, 5 and 6, 1978 (cont'd.)

| | |
|---|---|
| Mr. D.G. McKay | Chairman and Chief Executive Officer<br>Pirelli Cables Inc. |
| Mr. J.H. Batt | Vice-President and Divisional Manager<br>Building Wires and Communications Cables<br>Pirelli Cables Inc. |
| Mr. S.J. Johnson | Marketing Manager<br>Communications Cables<br>Pirelli Cables Inc. |
| Mr. J. Sebastyan | Vice-President<br>Marketing and Sales<br>International Systcoms Limited |

### Toronto, April 17, 18, 19, 20 and 21, 1978

| | |
|---|---|
| Mr. J.H. Stevens | Chairman of the Board and Chief Executive Officer<br>Canada Wire and Cable Limited |
| Mr. S.T. Luck | Owner and Manager<br>Sid Luck Enterprises |
| Mr. H.M. Campbell | Vice-President<br>National Laser Products Limited<br>- and General Manager and Chief Operating Officer<br>Calling All People |
| Mr. I.G. Kaye | President<br>Ivor Kaye & Associates |
| Mr. F.R. Lamb | General Manager<br>Wescom Canada Limited |

## Toronto, April 17, 18, 19, 20 and 21, 1978 (cont'd.)

| | |
|---|---|
| Mr. E.B. Fletcher | President<br>Commonwealth Holiday Inns of Canada Limited |
| Mr. S. Maqsood | Financial Analyst<br>Commonwealth Holiday Inns of Canada Limited |
| Mr. R. Chouinard | Consultant<br>Parsec Communications Limited - for Commonwealth Holiday Inns of Canada Limited |

## St. John's, Nfld., May 16 and 17, 1978

| | |
|---|---|
| Mr. A.A. Brait | President, Managing Director and Chief Executive Officer<br>Newfoundland Telephone Company Limited |
| Mr. C.G. Webster | Chief Engineer<br>Telecommunications Division<br>Canadian National Railway |

## Charlottetown, May 19 and 20, 1978

| | |
|---|---|
| Mr. J. Hennessey | Charlottetown, P.E.I. |
| Mr. I.E.H. Duvar | Chairman of the Board and President<br>The Island Telephone Company Limited |
| Mr. A.V. Groom | President and Chief Executive Officer<br>Garden of the Gulf Court & Motel, Inc.<br>- (franchise of Quality Inns) |

## Ottawa, May 23, 24 and 25, 1978

| | |
|---|---|
| Mr. K.E. Hancock | Director<br>Engineering<br>Canadian Cable Television Association |
| Mr. R.C. Chaston | President and General Manager<br>York Cablevision Limited<br>- Member of the Canadian Cable Television Association |
| Mr. O. Girard | President<br>Transvision Magog Inc.<br>- Member of the Canadian Cable Television Association |
| Mr. W.J. Simpson | President<br>W.J. Simpson Consultants Ltd.<br>- Member of the Canadian Cable Television Association |
| Mr. H.M. Campbell | Vice-President<br>National Laser Products Limited<br>- and General Manager and Chief Operating Officer<br>Calling All People |

## Vancouver, June 5, 6, 7, 8 and 9, 1978

| | |
|---|---|
| Mr. J.T. Bryson | President<br>Tell A Phone Systems Inc. |
| Mr. F. Toy | Chairman<br>Canadian Airlines Telecommunications Association<br>- and Director<br>Radio Communications<br>Pacific Western Airlines Ltd. |

## Vancouver, June 5, 6, 7, 8 and 9, 1978 (cont'd.)

| | |
|---|---|
| Dr. W.H. Melody | Professor and Chairman<br>Department of Communication Studies<br>Simon Fraser University |
| Dr. D.W. Smythe | Professor<br>Department of Communication Studies<br>Simon Fraser University |
| Mr. H.C. Merry | President<br>The Canadian Radio Common Carriers Association<br>- and Operations Manager<br>Western Radio Services Ltd. |
| Mr. W.S. Van Derripe | Consultant for British Columbia Hotels Association |

## Ottawa, June 20, 22 and 23, 1978

| | |
|---|---|
| Dr. R.E. Babe | Associate Professor<br>Department of Communication Studies<br>Simon Fraser University |
| Mr. G.A. Poch | Group Legal Counsel<br>North America Telecommunications<br>International Telephone and Telegraph Corporation |
| Mr. F.P. Barnes | Senior Vice-President and Group Product Manager<br>Telecommunications Products and Systems Worldwide<br>International Telephone and Telegraph Corporation |

### Ottawa, June 20, 22 and 23, 1978 (cont'd.)

| | |
|---|---|
| Mr. K. Cameron | President and General Manager<br>Communications Division<br>ITT Industries of Canada Limited |
| Mr. D. Lucas | Director of Sales<br>ITT Canada Limited |

### Montreal, June 27, 28, 29 and 30, 1978

| | |
|---|---|
| Mr. D.G. McKay | Chairman and Chief Executive Officer<br>Pirelli Cables Inc. |
| Mr. J.H. Batt | Vice-President and Divisional Manager<br>Building Wires and Communications Cables<br>Pirelli Cables Inc. |
| Mr. S.J. Johnson | Marketing Manager<br>Communications Cables<br>Pirelli Cables Inc. |
| Mr. D.J. Hadley | President<br>Farinon Canada Limited |
| Mr. T.F. Heenan | President<br>TransCanada Telephone System |
| Mr. E.B. Spievack | General Counsel<br>North American Telephone Association |
| Mr. E. Meitner | Shareholder<br>Sacom Communications Ltd. |
| Mr. E.W. Fox | Shareholder<br>Sacom Communications Ltd. |

## Vancouver, September 18, 19, 20, 21 and 22, 1978

| | |
|---|---|
| Dr. P.A. Goud | Department of Electrical Engineering<br>The University of Alberta<br>- (no appearance - letter of June 29, 1978 to the Prime Minister read into the record) |
| Mr. H.R. Herron | President and Chief Executive Officer<br>GTE Automatic Electric (Canada) Ltd. |
| Mr. E.V. Hird | President and Chief Executive Officer<br>GTE Lenkurt Electric (Canada) Ltd. |
| Mr. W.G. Clark | Business Agent<br>Plant Division<br>Telecommunications Workers Union, B.C. |
| Mr. P. Legge | Economist<br>Telecommunications Workers Union, B.C. |

## Vancouver, September 25, 26, 27, 28 and 29, 1978

| | |
|---|---|
| Mr. H.C. Merry | President<br>The Canadian Radio Common Carriers Association<br>- and Operations Manager<br>Western Radio Services Ltd. |
| Dr. R.E. Babe | Associate Professor<br>Department of Communication Studies<br>Simon Fraser University |

### Vancouver, September 25, 26, 27, 28 and 29, 1978 (cont'd.)

| | |
|---|---|
| Mr. C.J. Stevens | General Manager<br>TASCO Telephone Answering Exchange Limited |

### Ottawa, October 16, 18, 19 and 20, 1978

| | |
|---|---|
| Mr. L.W. Jones | General Manager<br>Telecommunications<br>Plessey Canada Limited |
| Mr. A.D. Moore | President<br>Siltronics Ltd. |
| Mr. E.B. Spievack | General Counsel<br>North American Telephone Association |
| Mr. E.B. Fletcher | President<br>Commonwealth Holiday Inns of Canada Limited |
| Mr. S. Maqsood | Financial Analyst<br>Commonwealth Holiday Inns of Canada Limited |
| Mr. R. Chouinard | Consultant<br>Parsec Communications Limited<br>- for Commonwealth Holiday Inns of Canada Limited |
| Mr. A.V. Groom | President and Chief Executive Officer<br>Garden of the Gulf Court & Motel, Inc.<br>- (franchise of Quality Inns) |
| Mr. V.R. Brand | President<br>Comtest Communications Products Limited |

Ottawa, October 16, 18, 19 and 20, 1978 (cont'd.)

| | |
|---|---|
| Mr. W.J. Wyler | General Manager<br>Comtest Communications<br>Products Limited |
| Teleglobe Canada | (Report to RTPC made<br>part of record as<br>Exhibit T-462) |

Ottawa, October 23, 24, 26 and 27, 1978

| | |
|---|---|
| Mr. J.G. Sutherland* | Vice-President<br>Telecommunications<br>Canadian Pacific Limited |
| Mr. K. Smiley | President<br>Telemaster Corporation |
| Mr. W. Welsh | General Manager<br>Telemaster Corporation |
| Mr. T. Malizia | Vice-President<br>Global Telephone Systems |
| Mr. J.L. Olsen | President and Chief<br>Executive Officer<br>Phillips Cables Limited |
| Mr. E.M. Strain | President<br>ESE Limited |

Ottawa, October 30 and 31, 1978

| | |
|---|---|
| Mr. S.H. Franke | President<br>Plantronics Canada Limited |
| Mr. E. Meitner | Shareholder<br>Sacom Communications Ltd. |
| Mr. E.W. Fox | Shareholder<br>Sacom Communications Ltd. |

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* Since January 1, 1980 Mr. Sutherland is President of CNCP Telecommunications.

## Ottawa, October 30 and 31, 1978 (cont'd.)

| | |
|---|---|
| Mr. S.A. Gillies | Secretary<br>Export Development Corporation |

## Ottawa, November 2, 1978

| | |
|---|---|
| Mr. C.G. Webster | Chief Engineer<br>Telecommunications Division<br>Canadian National Railway |
| Mr. J.D. Goss | General Manager<br>Newfoundland Subdivision<br>CN Telecommunications<br>St. John's, Nfld. |
| Mr. R.J. Wells | General Manager<br>Northwest Telephone Operations<br>Canadian National Railway<br>Whitehorse |

## Ottawa, November 6, 7, 8 and 9, 1978

| | |
|---|---|
| Mr. S.M. Kideckel | President<br>Challenge Communications Limited |
| Mr. H. McGuire | Manager<br>Systems Procurement<br>Telesat Canada |
| Mr. D. Cunningham | President<br>Gandalf Data Communications Ltd. |
| Mr. L.D. Clarke | Chairman of the Board and Chief Executive Officer<br>Spar Aerospace Limited |
| Mr. I.A. Mayson | Vice-President and General Manager<br>Spar Technology Limited<br>A Division of Spar Aerospace Limited |

## Ottawa, November 13, 14, 16 and 17, 1978

| | |
|---|---|
| Mr. R.M. Moley | Vice-President<br>Marketing<br>Rolm Corporation<br>Santa Clara, California<br>- and Executive Vice-President<br>Rolm Corporation of Canada Limited |
| Mr. J.M. Kasson | Vice-President<br>Engineering<br>Rolm Corporation<br>Santa Clara, California |
| Mr. C.E. Bell | Director of Sales<br>Rolm Corporation of Canada Limited |
| Mr. R.S. Bessette | President<br>Transcom Electronics Manufacturing Ltd. |
| Mr. A.R. Monk | President<br>House of Telephones |
| Mr. B. Isakson | President and General Manager<br>NIFE-Powertronic Corporation |
| Mr. M.S. Ikonomidis | Product Manager<br>Telecommunications<br>NIFE-Powertronic Corporation |
| Mr. W.E. Cowie | Victoria, B.C.<br>- (no appearance - letter read into the record) |

## Ottawa, November 20, 21, 22, 23 and 24, 1978

| | |
|---|---|
| Mr. R.A. Hay | Executive Director<br>Ontario Hospital Association |

### Ottawa, November 20, 21, 22, 23 and 24, 1978 (cont'd.)

| | |
|---|---|
| Mr. S.A. Gillies | Secretary<br>Export Development Corporation |
| Dr. R.E. Babe | Associate Professor<br>Department of Communication Studies<br>Simon Fraser University |

### Ottawa, November 28, 29 and 30, 1978

| | |
|---|---|
| Dr. R.E. Babe | Associate Professor<br>Department of Communication Studies<br>Simon Fraser University |
| Mr. J.G. Sutherland | Vice-President<br>Telecommunications<br>Canadian Pacific Limited |

### Ottawa, December 4, 5, 6 and 7, 1978

| | |
|---|---|
| Mr. F.A. Hanning | Past President<br>Canadian Industrial Communications Assembly |
| Mr. E.M. Wade | CICA Member of the Terminal Attachment Program Advisory Committee of the Department of Communications |
| Mr. C.G. Grant | President<br>Southern Pacific Communications Company |
| Mr. E.M. Strain | President<br>ESE Limited |
| Mr. K. Smiley | President<br>Telemaster Corporation |

### Ottawa, December 4, 5, 6 and 7, 1978 (cont'd.)

| | |
|---|---|
| Mr. W. Welsh | General Manager<br>Telemaster Corporation |
| Mr. A.M. Hase | President<br>Staticon Ltd. |

### Ottawa, December 11, 13, 14 and 15, 1978

| | |
|---|---|
| Mr. L.W. Jones | General Manager<br>Telecommunications<br>Plessey Canada Limited |
| Mr. A.D. Moore | President<br>Siltronics Ltd. |
| Mr. V.R. Brand | President<br>Comtest Communications<br>Products Limited |
| Mr. W.J. Wyler | General Manager<br>Comtest Communications<br>Products Limited |
| Mr. G.D. Clark | Chairman, President and<br>Chief Executive Officer<br>RCA Limited<br>Canada |
| Mr. K.T. Statmore | Staff Vice-President<br>and Senior Counsel<br>RCA Service Company<br>Camden, New Jersey |
| Mr. J.W. Bakas | Manager<br>Technical Planning<br>RCA Service Company<br>Camden, New Jersey |

## Ottawa, December 11, 13, 14 and 15, 1978 (cont'd.)

| | |
|---|---|
| Mr. M.S. Gold | President<br>Harding Communications Limited |
| Mr. R.W. Walton | General Manager<br>Harding Communications Limited |

## Ottawa, December 18, 1978

| | |
|---|---|
| Mr. R. Brandt | President<br>Trans-Lux Corporation |

## Ottawa, January 15, 16, 17 and 18, 1979

| | |
|---|---|
| Mr. L. Larry | President<br>Fein Yarns Manufacturing Limited |
| Mr. S.M. Kideckel | President<br>Challenge Communications Limited |
| Mr. H. McGuire | Manager<br>Systems Procurement<br>Telesat Canada |
| Mr. L.W. Reist | Program Manager<br>Leigh Instruments Limited |

## Ottawa, January 22, 24, 25 and 29, 1979

| | |
|---|---|
| Mr. D. Cunningham | President<br>Gandalf Data Communications Ltd. |
| Mr. C. Patterson | Vice-President<br>Gandalf Data Communications Ltd. |

### Ottawa, January 22, 24, 25 and 29, 1979 (cont'd.)

| | |
|---|---|
| Mr. D.I. Snell | Vice-President<br>Computer Assembly Systems, Limited |
| Mr. R.S. Bessette | President<br>Transcom Electronics Manufacturing Ltd. |
| Mr. R.M. Doig | General Manager and Secretary-Treasurer<br>Unified Technologies Incorporated |
| Mr. F.A. Hanning | Past President<br>Canadian Industrial Communications Assembly |
| Mr. E.M. Wade | CICA Member of the Terminal Attachment Program Advisory Committee of the Department of Communications |

### Ottawa, February 8, 12, 13, 14 and 15, 1979

| | |
|---|---|
| Mr. C.G. Grant | President<br>Southern Pacific Communications Company |
| Mr. G.D. Clark | Chairman, President and Chief Executive Officer<br>RCA Limited<br>Canada |
| Mr. K.T. Statmore | Staff Vice-President and Senior Counsel<br>RCA Service Company<br>Camden, New Jersey |

### Ottawa, February 8, 12, 13, 14 and 15, 1979 (cont'd.)

| | |
|---|---|
| Mr. J.W. Bakas | Manager<br>Technical Planning<br>RCA Service Company<br>Camden, New Jersey |
| Mr. B.E. Ruscoe | Vice-President<br>Sales and Marketing<br>Mirtone Industries Ltd. |
| Mr. T. Falbo | Vice-President and<br>General Manager<br>Mirtone Industries Ltd. |
| Mr. L.D. Clarke | Chairman of the Board and<br>Chief Executive Officer<br>Spar Aerospace Limited |
| Mr. I.A. Mayson | Vice-President and<br>General Manager<br>Spar Technology Limited<br>A Division of Spar Aerospace<br>Limited |

### Ottawa, February 20, 21 and 22, 1979

| | |
|---|---|
| Mr. A.M. Hase | President<br>Staticon Ltd. |
| Mr. L.W. Reist | Program Manager<br>Leigh Instruments Limited |
| Mr. R.M. Doig | General Manager and<br>Secretary-Treasurer<br>Unified Technologies<br>Incorporated |
| Mr. E.H. Cole | Assistant Vice-President<br>Business Development<br>The Western Union<br>Telegraph Company<br>U.S.A. |

### Ottawa, March 1, 2, 5, 6, 7 and 8, 1979

| | |
|---|---|
| Mr. R. Brandt | President<br>Trans-Lux Corporation |
| Mr. D.I. Snell | Vice-President<br>Computer Assembly Systems, Limited |
| Mr. B. Isakson | President and General Manager<br>NIFE-Powertronic Corporation |
| Mr. M.S. Ikonomidis | Product Manager<br>Telecommunications<br>NIFE-Powertronic Corporation |
| Mr. W.S. Van Derripe | Consultant for British Columbia Hotels Association |
| Mr. J.M. Cameron | Marketing Planning Manager<br>British Columbia Telephone Company |

### Ottawa, April 2 and 3, 1979

| | |
|---|---|
| Mr. B.E. Ruscoe | Vice-President<br>Sales and Marketing<br>Mirtone Industries Ltd. |
| Mr. R.M. Doig | General Manager and Secretary-Treasurer<br>Unified Technologies Incorporated |

### Ottawa, April 9, 10 and 11, 1979

| | |
|---|---|
| Mr. E.H. Cole | Assistant Vice-President<br>Business Development<br>The Western Union Telegraph Company<br>U.S.A. |

### Ottawa, April 9, 10 and 11, 1979 (cont'd.)

| | |
|---|---|
| Mr. R.M. Moley | Vice-President<br>Marketing<br>Rolm Corporation<br>Santa Clara, California<br>- and Executive Vice-President<br>Rolm Corporation of Canada Limited |
| Mr. J.M. Kasson | Vice-President<br>Engineering<br>Rolm Corporation<br>Santa Clara, California |
| Mr. C.E. Bell | Director of Sales<br>Rolm Corporation of Canada Limited |

### Ottawa, April 23 and 27, 1979

| | |
|---|---|
| Mr. B. Isakson | President and General Manager<br>NIFE-Powertronic Corporation |
| Mr. M.S. Ikonomidis | Product Manager<br>Telecommunications<br>NIFE-Powertronic Corporation |
| Mr. B.W. Richardson | Former President<br>NIFE-Powertronic Corporation |
| Mr. D.E. Bawden | Vice-President<br>NIFE-Powertronic Corporation |
| Mr. R.A. Hay | Executive Director<br>Ontario Hospital Association |

### Ottawa, June 6 and 7, 1979

| | |
|---|---|
| Mr. T. Lamoureux | Executive Director<br>Telocator Network of America |

Ottawa, June 6 and 7, 1979 (cont'd.)

| | |
|---|---|
| Mr. T. Ryan | President<br>The Canadian Radio Common<br>Carriers Association |

Ottawa, July 10 and 11, 1979

| | |
|---|---|
| Mr. W.D. English | Vice-President and<br>General Counsel<br>Satellite Business Systems |
| Mr. C.S. Congelosi | Vice-President and<br>General Counsel<br>RCA American Communications, Inc. |
| Mr. P. Schneider | Vice-President<br>Satellite Systems and Service<br>The Western Union Telegraph<br>Company |
| Mr. E. Fthenakis | President<br>American Satellite Corporation |
| Mr. I.G. Kaye | President<br>Facscan Incorporated |

Ottawa, September 10, 11 and 12, 1979

| | |
|---|---|
| Mr. O.O. Druckenmiller | Director<br>Communication Systems<br>AMF Incorporated |
| Mr. M. Earley | Director<br>Voice Systems<br>The Continental Corporation |
| Mr. R.J. Kaufman | Manager<br>Telecommunications Services<br>Damon Corporation |

### Ottawa, September 10, 11 and 12, 1979 (cont'd.)

| | |
|---|---|
| Mr. A.R. Robinson | Corporate Telecommunications<br>Royal Trust |
| Mr. R. Ballentine | Chairman of the Board<br>Calendar Magazines |

### Vancouver, September 18, 19 and 20, 1979

| | |
|---|---|
| Mr. G.V. Lauk, M.L.A. | Parliament Buildings<br>Victoria, B.C. |
| Mr. J.H.S. Campbell | President<br>Consultec Canada Limited |
| Mr. R. Parkinson | Consultant<br>Consultec Canada Limited |

### Ottawa, October 22, 23, 24, 26 and 30, 1979

| | |
|---|---|
| Mr. J.W. Hart, C.A. | Partner<br>Price Waterhouse & Co. |
| Mr. R.S. Carson | Partner<br>Price Waterhouse & Co. |
| Mr. A.R. Robinson | Corporate Telecommunications<br>Royal Trust |

### Ottawa, November 15 and 20, 1979

| | |
|---|---|
| Mr. T.H. Matthews | Executive Vice-President<br>Mitel Corporation |

### Ottawa, December 3, 4 and 5, 1979

| | |
|---|---|
| Mr. G.F. MacFarlane | Chairman of the Board and<br>Chief Executive Officer<br>British Columbia Telephone<br>Company |

## Ottawa, December 3, 4 and 5, 1979 (cont'd.)

| | |
|---|---|
| Mr. D.M. Carter | Chief Engineer<br>British Columbia Telephone Company |

## Ottawa, December 17 and 18, 1979

| | |
|---|---|
| Mr. T.H. Matthews | Executive Vice-President<br>Mitel Corporation |
| Mr. J.M. Beddoes | Executive Vice-President<br>Atomic Energy of Canada<br>Radiochemical Company<br>Commercial Products Division<br>- formerly of Microsystems International Limited |

## Ottawa, January 15 and 16, 1980

| | |
|---|---|
| Mr. J.M. Beddoes | Executive Vice-President<br>Atomic Energy of Canada<br>Radiochemical Company<br>Commercial Products Division<br>- formerly of Microsystems International Limited |
| Mr. A.G. Lester | Executive Vice-President<br>(Corporate Studies)<br>Bell Canada<br>- (now retired) |

## Ottawa, February 27 and 28, 1980

| | |
|---|---|
| Mr. A.G. Lester | Executive Vice-President<br>(Corporate Studies)<br>Bell Canada<br>- (now retired) |

### Ottawa, March 3, 4, 5 and 6, 1980

| | |
|---|---|
| Mr. J.A. Harvey | Assistant Vice-President<br>(Technology Development)<br>Bell Canada |
| Mr. G.E. Inns | Executive Vice-President<br>(Ontario Region)<br>Bell Canada |

### Ottawa, April 29 and 30, 1980

| | |
|---|---|
| Mr. J.V.R. Cyr | Executive Vice-President<br>(Administration)<br>Bell Canada |

### Ottawa, May 1, 2 and 3, 1980

| | |
|---|---|
| Mr. J.V.R. Cyr | Executive Vice-President<br>(Administration)<br>Bell Canada |
| Mr. B.H. Tavner | General Manager<br>Network Services<br>(Ontario Provincial)<br>Bell Canada |

### Ottawa, May 8 and 9, 1980

| | |
|---|---|
| Mr. B.H. Tavner | General Manager<br>Network Services<br>(Ontario Provincial)<br>Bell Canada |

### Ottawa, May 12, 13, 15 and 16, 1980

| | |
|---|---|
| Mr. J.M. Thompson | Assistant Vice-President<br>(Materiel and Automative<br>Equipment)<br>Bell Canada |

### Ottawa, May 12, 13, 15 and 16, 1980 (cont'd.)

| | |
|---|---|
| Dr. C.D. Hall | President<br>Bell-Northern Research Ltd. |

### Ottawa, June 2, 3, 4 and 5, 1980

| | |
|---|---|
| Mr. P.E. Skelton | Assistant Vice-President<br>(Rates)<br>Bell Canada |
| Mr. O. Tropea | Executive Vice-President<br>(Corporate)<br>Bell Canada |

### Ottawa, June 24, 25, 26 and 27, 1980

| | |
|---|---|
| Mr. F.E. Ibey | Executive Vice-President<br>(Operations)<br>Bell Canada |
| Mr. D.C. Owen | General Director<br>Engineering Economics<br>Bell Canada |
| Mr. J.D.M. Davies | Vice-President<br>(Business Development)<br>Northern Telecom Limited |

### Ottawa, August 5 and 6, 1980

| | |
|---|---|
| Mr. W.R. Brown | Director of<br>Independent Company Relations<br>(Ontario Region)<br>Bell Canada<br>- (now retired) |

### Ottawa, October 20, 21 and 22, 1980

| | |
|---|---|
| Mr. J.D.M. Davies | Vice President<br>(Business Development)<br>Northern Telecom Limited |

### Ottawa, November 12, 13 and 14, 1980

| | |
|---|---|
| Dr. D.A. Chisholm | Executive Vice-President<br>(Technology)<br>Northern Telecom Limited |
| Mr. J.D.M. Davies | Vice-President<br>(Business Development)<br>Northern Telecom Limited |

### Ottawa, December 1, 2, 3, 4 and 5, 1980

| | |
|---|---|
| Mr. C.G. Millar | Executive Vice-President<br>(Operations)<br>Northern Telecom Limited |
| Mr. D.F. Hudson | Vice-President<br>(Subscriber Switching)<br>Northern Telecom<br>Industries, Inc. |

### Ottawa, December 19, 1980

| | |
|---|---|
| Mr. T.E. Hodgkinson | Chairman<br>Australian Telecommunications<br>Development Association |

### Ottawa, February 4, 1981

| | |
|---|---|
| Mr. J.F. Grandy | President<br>Reisman & Grandy Limited |

Ottawa, February 4, 1981 (Cont'd)

| | |
|---|---|
| Mr. J.C. Tickell | Ottawa, Ont.<br>- (no appearance - letter read into the record) |

Ottawa, February 10, 1981

| | |
|---|---|
| Mr. M.R. Leenders | Professor and Chairman<br>Operations Management<br>School of Business Administration<br>University of Western Ontario |

Ottawa, March 9, 1981

| | |
|---|---|
| Mr. D.C.A. Curtis | Professor of Economics<br>Trent University |

Ottawa, April 13 and 14, 1981

| | |
|---|---|
| Mr. A.J. de Grandpré, Q.C. | Chairman of the Board and<br>Chief Executive Officer<br>Bell Canada |

Ottawa, May 8, 1981

| | |
|---|---|
| Mr. G. Elliot | Director General<br>Office of General Trade Relations<br>International Trade Relations<br>Department of Industry, Trade and Commerce |
| Mr. Yukuo Moriyama<br>Mr. Dara L. OhUiginn | Representatives<br>International Marketing<br>Mitel Corporation |

Ottawa, May 8, 1981 (Cont'd)

| | |
|---|---|
| Mr. W.E. Jones | Ottawa, Ont.<br>- (no appearance - letter read into the record) |

# APPENDIX B

## APPEARANCES

| Representing | Counsel |
|---|---|
| A.E.I. Telecommunications (Canada) Limited | Mr. F.L. Cvitkovitch, Q.C. |
| Aylmer and Malahide Telephone Company Limited (The) (now "Amtelecom Inc.") | Mr. R.R. Cranston |
| Bell Canada | Mr. J.W. Brown, Q.C.<br>Mr. W.D. Grover, Q.C.<br>Mr. B. Kellock<br>Mr. A.J. MacIntosh, Q.C.<br>Mr. D.C. Ross<br>Mr. A.J. Stewart |
| Bell-Northern Research Ltd. | Mr. P. Genest, Q.C.<br>Mr. J.T. DesBrisay, Q.C. |
| British Columbia Government | Mr. E.R.A. Edwards |
| British Columbia Hotels Association | Mr. W.R. Ellison |
| British Columbia Telephone Company | Mr. P.W. Butler<br>Mr. K.D.A. Morrison |
| Business Intervenors Society | Mr. C. Cousineau |

| Representing | Counsel |
|---|---|
| Calling All People (Service of National Laser Products Ltd.) | Mr. R.L. Colson |
| Canada Wire and Cable Limited | Mr. C.G. Cowan, Q.C.<br>Mr. J.F. Rook |
| Canadian Cable Television Association | Mr. B.C. McDonald |
| Canadian Motorola Electronics Company | Mr. J.W. Rowley |
| Canadian National Railway (CN Telecommunications) | Mr. M. Rabin |
| Canadian Pacific Limited (CP Telecommunications) | Mr. C.R.O. Munro, Q.C. |
| Challenge Communications Limited | Mr. B.V. Levinter, Q.C. |
| Consumers' Association of Canada | Mr. T.G. Kane |
| Director of Investigation and Research | Mr. G.F. Henderson, Q.C.<br>Mr. G.E. Kaiser |
| 'edmonton telephones | Mr. A. Konye |

| Representing | Counsel |
|---|---|
| GTE Automatic Electric (Canada) Ltd. | Mr. P.W. Butler<br>Mr. C.C. Locke, Q.C. |
| GTE Lenkurt Electric (Canada) Ltd. | Mr. P.W. Butler<br>Mr. C.C. Locke, Q.C. |
| Green, Michaels and Associates Ltd. | Mr. C. Cousineau |
| Hulbert, E.H. | Mr. H.D. Williamson |
| International Telephone and Telegraph Corporation | Mr. G.A. Poch |
| Manitoba Telephone System | Mr. J.M. McGuire |
| Mitel Corporation | Mr. K.H.E. Plumley |
| New Brunswick Telephone Company, Limited (The) | Mr. B.C. Stuart |
| Newfoundland Telephone Company Limited | Mr. J.R. Chalker, Q.C. |
| North American Telephone Association | Mr. E.B. Spievack |
| Northern Telecom Limited | Mr. G. Adams<br>Mr. L. Berger<br>Mr. J.T. DesBrisay, Q.C.<br>Mr. P. Genest, Q.C.<br>Mr. P.S. Rouleau |

| Representing | Counsel |
|---|---|
| Okanagan Telephone Company | Mr. P.W. Butler |
| Ontario Government | Mr. D.W. Burtnick, Q.C.<br>Mr. N.J. McCallum |
| Phillips Cables Limited | Mr. B. Lisowski |
| Philips Electronics Ltd. | Mr. E.L. Versteeg |
| Pirelli Cables Inc. | Mr. G.B. Maughan |
| Plantronics Canada Limited | Mr. P.S. Martin |
| Quebec Government | Mr. M. Cantin<br>Mr. L. Bilodeau<br>Miss C. Samuel |
| RCA American Communications Inc. | Mr. C.S. Congelosi |
| RCA Limited | Mr. L. J.-P. Joly |
| RCA Service Company | Mr. K.T. Statmore |
| Rolm Corporation | Mr. W.G. Friedman |
| Sacom Communications Ltd. | Mr. I. Myszka |

| Representing | Counsel |
|---|---|
| Saskatchewan Government | Mr. G. Taylor |
| Saskatchewan Telecommunications | Mr. T.A. Howe |
| Satellite Business Systems | Mr. W.D. English |
| Southern Pacific Communications Company | Mr. J.V. Kenny |
| TASCO Telephone Answering Exchange Limited | Mr. P.N.M. Glass |
| Telesat Canada | Mr. R.W. Wieleba |
| TransCanada Telephone System | Mr. J.R. Tolmie, Q.C. |
| Trans-Lux Corporation | Mr. R.H. Chartrand |
| Vidar (A Division of TRW Inc.) | Mr. D. Ficksman |